THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXI. No. 1567.] LONDON, MAY 23, 1893. [45TH YEAR. PRICE 6d.

"TORBAY PAINTS."

THE ORIGINAL,

As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.

	Ground in Oil Paste. Per Cwt.	Mixed ready for use. Per Cwt.
"Torbay Red Oxide" - -	22s.	26s.
"Torbay Chocolate Oxide" -	22s.	26s.
"Torbay Gas Stone Colour"	27s.	30s.

Carriage Paid to any Railway Station in England or Wales.

TORBAY & DART PAINT Co., Ld.,
DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.

THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
See Advt. p. III., centre of JOURNAL.

Lanemark Coal Co.,
LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,
NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

THE WIGAN COAL & IRON CO., LIMTD.,

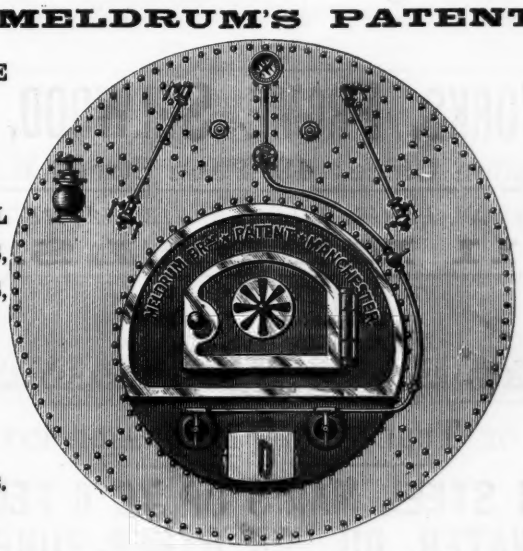
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE NO. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

DUST-FUEL FURNACE
(MELDRUM'S PATENT).

BURNS ANY KIND OF WASTE FUEL TO ADVANTAGE.

SUPPLIED to the PRINCIPAL GAS-WORKS, WATER-WORKS, ELECTRIC LIGHT STATIONS, &c., &c.



1200 WORKING.

LONDON OFFICE:
16, UNION COURT,
OLD BROAD STREET, E.C.
WILLIAM BOBY, Agent.

MELDRUM BROS., ATLANTIC WORKS, 13, CITY ROAD, **MANCHESTER.**
Telegrams: "MELDRUM MANCHESTER." *National Telephone No. 1674.*

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765),

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

EDWARD COCKEY & SONS, LIMITED,

ENGINEERS & CONTRACTORS FOR GAS-WORKS,

MAKERS OF FISH AND SMITH'S PATENT (NO. 5108) OVERFLOWS FOR REGULATING THE SEAL IN GAS-WASHERS, &c.

TELEGRAPHIC ADDRESS: "COCKEYS FROME."

Improved Dry-Faced Centre Valves for Working either One, Two, Three, or Four Purifiers at one time; giving an increase of Purifying Area above that obtainable with ordinary Centre Valves of 33⅓ per Cent.

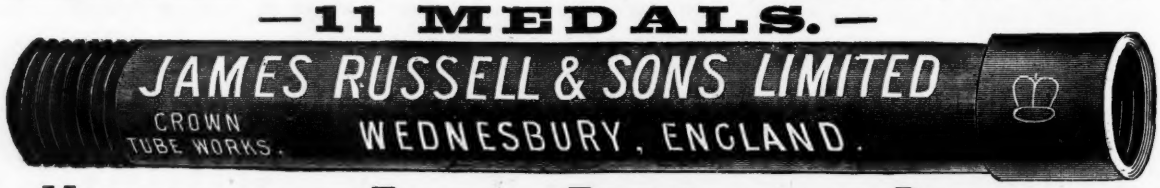
PRICES ON APPLICATION TO THE SOLE MAKERS.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

London Office: 49, Fann Street, E.C.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—



MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street.

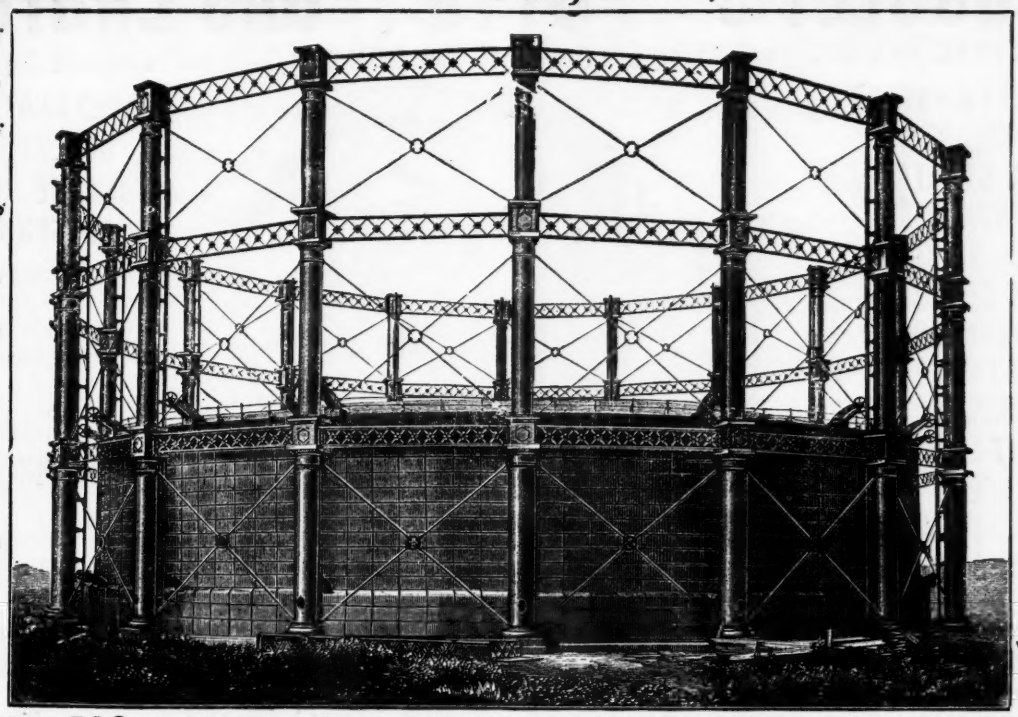
BIRMINGHAM: 114, Colmore Row.

LEEDS: 6, Mark Lane New Briggate.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED.

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

GAS COAL.

BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES, WITH RACK & PINION OR Internal or External SCREWS, of all Sizes.

GASHOLDERS, AND Gasholder Tanks.

CAST-IRON RETORTS,

RETORT-BED FITTINGS,

And Retort-House Appliances

of every description.

Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

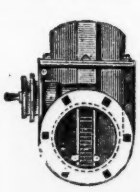
WROUGHT AND CAST IRON CONDENSERS, SCRUBBERS, & WASHERS,

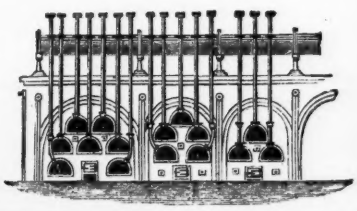
TAR AND LIQUOR PUMPS, &c.

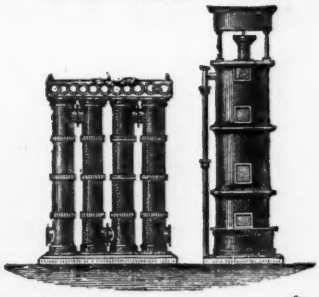
PATENT CENTRE VALVES

for working Purifiers.

Also Bye-Pass & Stop Valves.





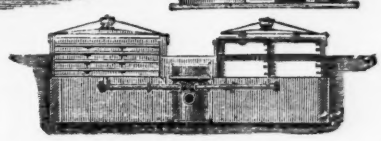


PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

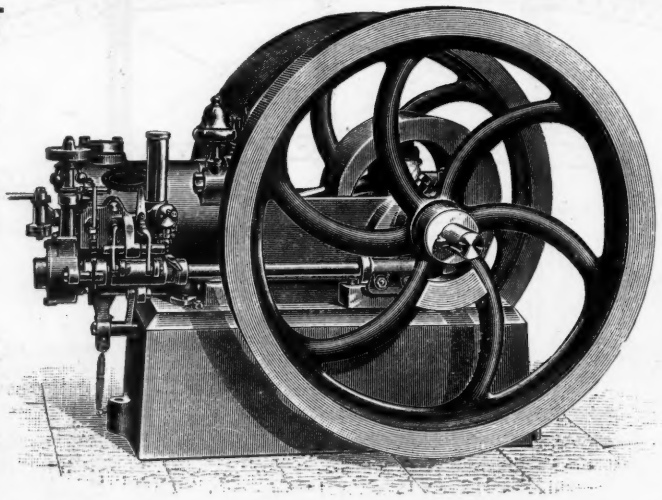
Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

CRYSTAL PALACE EXHIBITION, "DIPLOMA OF HONOUR"—Highest Award to Gas-Engines.

CROSSLEY'S PATENT OIL-ENGINES, PATENT STARTERS, PATENT TUBES FOR IGNITION, PATENT PENDULUM GOVERNORS, PATENT SAFETY HANDLES, PATENT TIMERS, PATENT ANTI-FLUCTUATING GAS-BAGS.



PATENT CATARACT GOVERNORS, CHANGE SPEED GOVERNORS.

Every Engine thoroughly tested before being sent out

ALL PARTS MADE STRICTLY TO GAUGE.

GREAT REDUCTION IN PRICES.

OVER 800 ENGINES ALWAYS IN HAND.

CROSSLEY'S NEW HIGH-SPEED ENGINE FOR DIRECT ELECTRIC LIGHTING.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.

HARRIS & PEARSON,

STOURBRIDGE, ENGLAND.

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

THE GAS-METER COMPANY, LIMITED.

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.

STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON, Established 1830.

For Prices and Particulars apply to

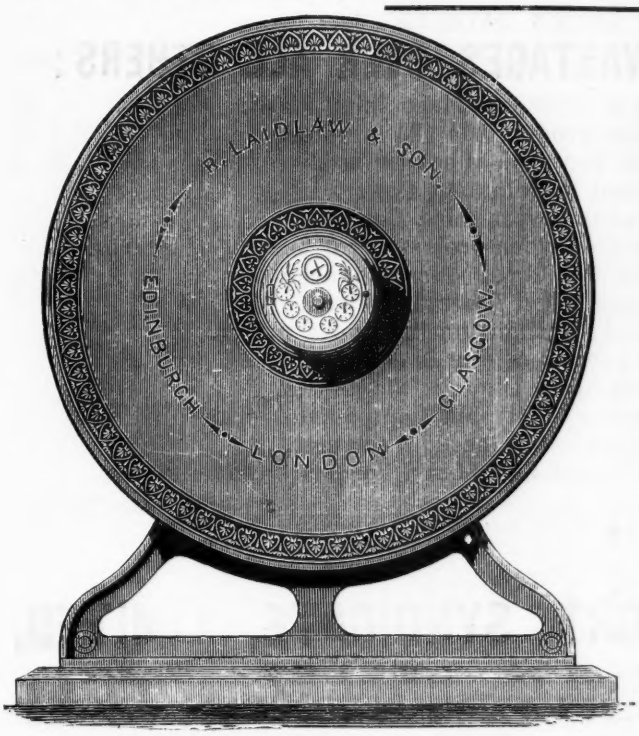
R. L. ANDREWS, General Manager.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

[See Advertisement on back of Wrapper.

R. LAIDLAW & SON'S
STATION METERS
IN ROUND OR SQUARE CASES, ALL SIZES.

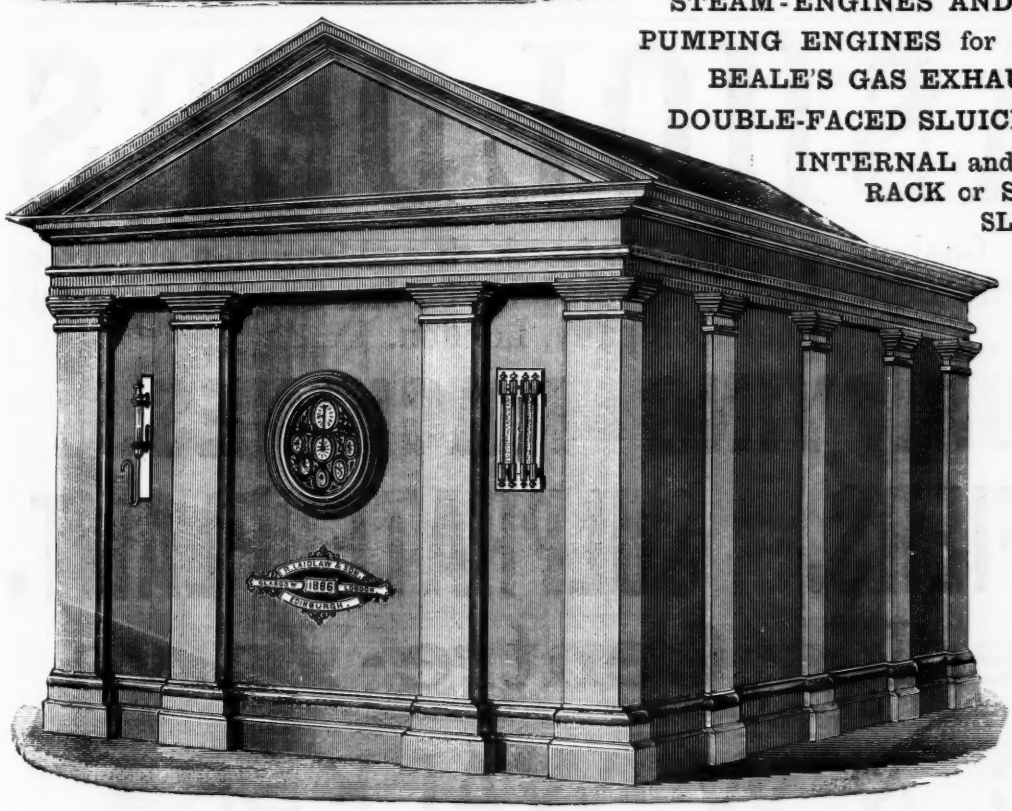


Makers in EDINBURGH of

WET AND DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS,
(To Indicate New Time),
PRESSURE GAUGES, TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST-METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.

Makers in GLASGOW of

CAST-IRON PIPES (all Sizes),
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES for Water-Works,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL and EXTERNAL RACK or SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, and WATER TANKS.
WROUGHT-IRON TUBES, FITTINGS, &c.



Descriptive Price Lists, Estimates, & full particulars forwarded on application.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

"YEADON"
REVOLVING GAS-RETORTS

(YEADON AND ADGIE'S PATENTS)

POSSESS THE FOLLOWING ADVANTAGES OVER ALL OTHERS:—

1. Occupy only one-fourth the space of ordinary Carbonizing Plant.
2. Continuous Automatic process; Gas produced in 12½ minutes.
3. Produce 25 per cent. more Gas per Ton of Coal carbonized.
4. Richer Gas of 15 per cent. additional Illuminating Power.
5. Utilize the smallest size, therefore the lowest price, Coal.
6. Proportionate increase from large Coal when broken as for Stoking-Machines.
7. Enrichment of Gas by Cannel Coal, Oils, &c., rendered unnecessary.
8. No deposit of Carbon in Retorts, or choked Ascension-Pipes.
9. Fogs conquered by the production of Gaslight on five hours' notice.
10. 25 per cent. of Lime saved in the process of Purification.
11. Retorts can be used for Revivifying Spent Lime in 20 minutes.
12. Revivify Spent Oxide for the recovery of Sulphur Compounds.
13. Sunday Ordinary Labour and Nightwork reduced 75 per cent.
14. Overwork and Overtime abolished; also Casual and Foreign Labour.

For Articles on and descriptive of the above Apparatus, see *Journal of Gas Lighting* for Dec. 13, 1892; March 7, April 25, and May 2, 1893. Also, the *Gas World*, Jan. 21 and May 6, 1893.

FULL PARTICULARS AND ESTIMATES GIVEN BY

THE YEADON GAS-RETORT SYNDICATE, LIMITED,

4, ALBION PLACE, LEEDS;

Or their Sole Representatives: D. M. NELSON & SONS, 68, Bath Street, GLASGOW.

GASHOLDERS

A Four-Lift Gasholder, nearly 200 feet high and 8 million cubic feet capacity, has been recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.
PURIFIERS. SULPHATE PLANT.
Weck's Centre-Valve.

C. & W. WALKER,

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

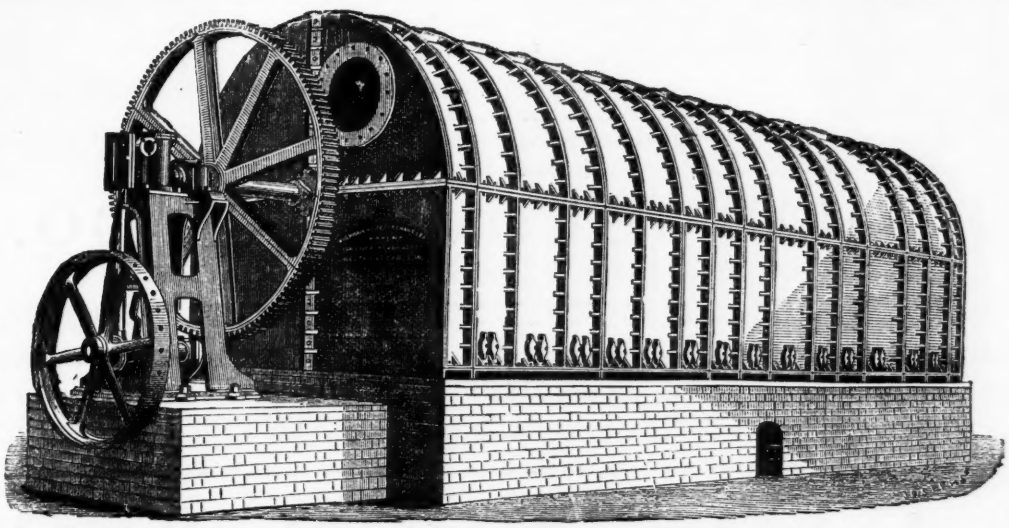
KIRKHAM, HULETT, & CHANDLER,

LIMITED.

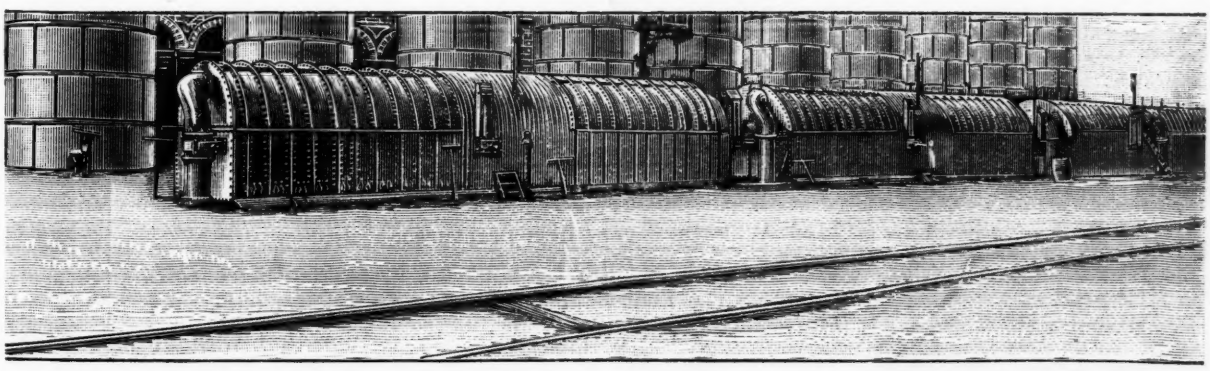
(SIDNEY HERSEY, Managing Director.) (J. CHANDLER, Engineer.)

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.



☛ **465 of these Machines (capable of dealing with 440,807,000 cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen, from Coal Gas.**



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company; the Engines driving same being under Galvanized Iron Covers. Six additional Machines are now in use at these Works.

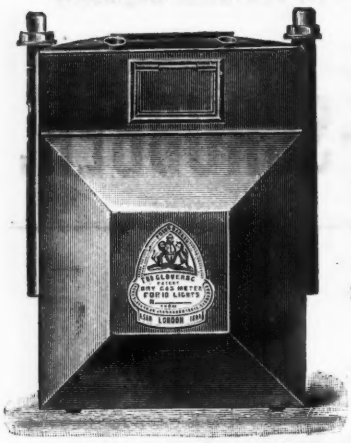
ADDRESS:—

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

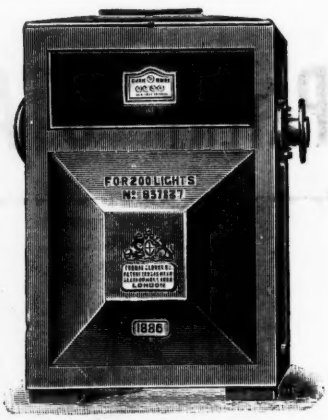
LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.



Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 3, BRIDGE ROW, DERITEND. *Telegraphic Address: "GOTHIC."*

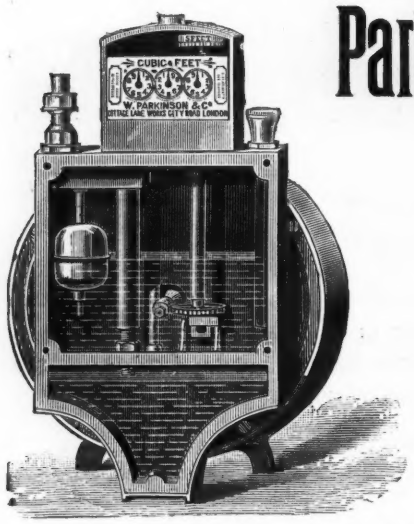
LEEDS: BOAR LANE CHAMBERS, 4, BASINGHALL STREET. *Telegraphic Address: "GOTHIC."*

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

W. PARKINSON & CO.

ESTABLISHED 1816.

MANUFACTURERS OF WET METERS.



Parkinson's Cast-Iron Case Meter.

Works with very little friction.

Will stand very high pressures.

Cannot possibly be shut off by sudden increase of pressure; the float being affected by outlet gas only.

Allows for loss of water by evaporation without materially affecting the registration or shutting off the gas.

Unexcelled for Simplicity of Construction, Excellence of Workmanship, and Accuracy of Registration.

COMPENSATING METERS,

In Tinned or Cast-Iron Cases.

COTTAGE LANE WORKS, CITY ROAD, **LONDON.** Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic Address: "PRECISION."

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

Papers and Discussions at the Institution Meeting . . . 921
The Birmingham Gas Committee and the Corporation . . . 922
Engineers Should Assert Themselves . . . 922
Trade Unionism Exhibited at Chicago . . . 922

WATER AND SANITARY AFFAIRS—

The London County Council and the Metropolitan Water Supply—Projected Legislation . . . 923
The State of the Manifold Ditch and the East London Water Supply . . . 924
The Bolton Corporation and their Water-Works Renewal Fund . . . 924

THE INCORPORATED INSTITUTION OF GAS ENGINEERS:—

GENERAL MEETING IN LONDON—

Papers Read (*concluded*)—
The Application of Weldon Mud to Gas Purification. By J. J. Hood, D.Sc., Assoc.R.S.M., and A. Gordon Salamon, Assoc.R.S.M., F.I.C. . 924
Inclined Retorts at the Coventry Gas-Works. By G. Winstanley . . 928
Improved System of Working Inclined Retorts. By J. F. Braidwood . 930
The Application of Machinery for Working Horizontal Retorts. By C. C. Carpenter . . . 931
Discussions on the Papers—
Mr. G. Livesey's Paper on Differential Prices for Gas . . . 933
Papers by Professor V. B. Lewes and Mr. A. G. Glasgow on Carburetted Water Gas . . . 939

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market . . . 945
Electric Lighting Memoranda . . . 945
The New Government Periodical . . . 946
Mr. S. R. Ogden . . . 947

NOTES:—

The Mechanical Equivalent of Heat . . . 947
The Most Costly Light Known . . . 947
Tar and Asphalte Tank Rendering . . . 948

COMMUNICATED ARTICLE:—

The Capital Invested in Gas Undertakings, and the Consumers of Gas. By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S. . . . 948

TECHNICAL RECORD:—

Ohio (U.S.A.) Gaslight Association—Annual Meeting at Columbus . . . 949

REGISTER OF PATENTS:—

Maintaining any Required Temperature in Gas-Heated Greenhouses, Ovens, &c.—Phillips, W. . . . 950
Tapping Water-Mains and Forming Branch Connections therewith under Pressure—Newton, P. A. (Burritt, H. H.) . . . 950
Valve Operating and Governing Mechanism for Gas-Engines—Hamilton, J. 950
Pressure-Regulators for Motors and Lighting Purposes—Busse, J. . . . 950
Lighthouse Illumination—Wigham, J. R. . . . 950
Patent Notices . . . 951

PARLIAMENTARY INTELLIGENCE:—

House of Lords—Progress of Bills . . . 951
House of Commons—The Water Supply of Llandrindod Wells; Progress of Bills . . . 951
House of Commons Committee—Plymouth, Stonehouse, and Devonport Water Bills . . . 952

LEGAL INTELLIGENCE:—

High Court of Justice—Queen's Bench Division—Young *v.* Southwark and Vauxhall Water-Works Company . . . 953

MISCELLANEOUS:—

Birmingham Corporation Gas and Water Supply—The Gas Committee's Report; Workmen's Holidays; The Water Committee's Report; the New Water Scheme . . . 954
Meeting of the Georgetown (British Guiana) Gas Company, Limited . . . 956
Meeting of the Bahia Gas Company, Limited . . . 956
Meeting of the Cape Town and District Gas Company, Limited . . . 956
Heywood Corporation Gas Department—The Price of Gas and the Profits 956
The London County Council and the Water Supply of the Metropolis—The Flow of the River Thames; Water Legislation . . . 957
Notes from Scotland . . . 958
Current Sales of Gas Products . . . 958
Coal Trade Reports . . . 958
Gas and Water Companies' Stock and Share List . . . 95

PARAGRAPHS.—The Cardiff Appointment, 923—Settlement of the Hull Dockers' Strike, 923—Gas Managers and Ambulance Work, 923—The London County Council and the Crystal Palace District Gas Bill, 945—Discovery of Deep-Seated Water under the London Basin, 945—The Purchase of the Stourbridge Gas-Works by the Town Commissioners, 945—Death of Mr. W. Richards, 946—The Huddersfield Corporation Water Engineer, 949—The Newbury Gas Undertaking, 951—The Price of Gas and Electric Lighting at Shrewsbury, 951—The Price of Gas in the Metropolis, 955—Extensions of the Pontypridd Water-Works, 955—Electric Lighting for Wakefield, 957—The Profits on the Burslem Gas Undertaking, 957—Sales of Shares, 957—Exhibitions of Gas Appliances, 957—Mossley Corporation Gas Supply, 957—The Bolton Gas Undertaking, 957—Malta and Mediterranean Gas Company, Limited, 957—The Barnet Gas and Water Company and their Brick-Making Contractor, 957—Water-Works Extensions at Southampton, 959—Adoption of Prepayment Meters at Sleaford, 959—Extensions at the Bolton Corporation Water-Works, 959—The Barnsley Corporation Water Engineer, 959.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 23, 1893.

Papers and Discussions at the Institution Meeting.

In another portion of the present number will be found a further instalment of our report of the proceedings at the recent meeting of the Institution of Gas Engineers. The discussion upon Mr. George Livesey's paper covered a wide range; and upon several of the points raised by different speakers a good deal yet remains to be said. For instance, in connection with the common practice of local authorities owning gas undertakings in the matter of levying an increased price from districts lying outside the municipal boundary, not a word was uttered respecting the complications that frequently arise when there is a large profit made upon the supply as a whole, and appropriated in relief of the rates within the municipal area. Yet it is notorious that the gravest troubles between neighbouring local authorities have been due to this cause; and Parliament has more than once been invoked to restore equitable dealing in such cases. Generally speaking, it would appear that fairness is more likely to appertain to uniform charges; and it is so difficult (to the verge of impossibility) to decide upon a sound principle of differentiation, that it seems better to start with uniformity, and put the onus of establishing the reasonableness of any exception to this rule upon those who favour it. There can be no abstract question of right and wrong about this problem of differential prices for gas, even as there is in regard to the idea of making gas consumers pay rates for people who are not consumers. It is purely a commercial issue, and must be decided in every case upon grounds of mere expediency. We agree to a large extent with Mr. Newbigging's observations on the much-debated point of the incidence of a heavy winter consumption upon a gas-works. This is greatly a question of latitude, and also of local commercial habitudes and characteristic industrial conditions; and the incidence is shown in the average cost of gas making. This being so, it is unnecessary to seek for any further correction, by special pricing, of a peculiarity of the business which has already manifested itself for what it may be worth. Mr. Newbigging's other remarks upon the justice of charging a low price for gas consumed in the neighbourhood of the works were open to some little misapprehension, which promptly happened. It is truly curious that, if an impromptu speaker expresses a clear thought in unexceptionable language, it commonly passes unnoticed; but let him fall into a small ambiguity of expression, and his words are sure to be seized upon by somebody, and sent into the world with added impetus to convey a meaning never intended by their framer. In this case, we believe that all Mr. Newbigging meant was to protest against such injustice as that mentioned by Mr. May, of Richmond, where consumers living next door to the works are made to pay more for their gas than is charged in the parish which the works are intended to supply. It would be difficult to deny the proposition that the "most favoured consumers" clause should apply to residents in the neighbourhood of gas-works, and this quite apart from the delicate question of whether or not a gas-works is essentially a nuisance in a neighbourhood.

It is also desirable to point out that considerable misunderstanding prevailed in the meeting with regard to the suggestion in Mr. Livesey's paper, attributed to Mr. Vernon Harcourt, that the illuminating power of gas should be yoked in a sliding scale with the initial price. Mr. Botley only expressed the common confusion of mind upon this head, which was hardly sufficiently dispelled by Mr. Livesey's reply. It is not, we take it, a suggestion for striking an average of the illuminating power of gas sold throughout any period of time, and regulating the price *post hoc, propter hoc*. Rather does it refer to a deliberate act of policy on the part of the gas-supplying authority, such as would be announced in advance. "Until further notice, the gas supplied in this district will "be of so many candles illuminating power, and the price "will consequently be so much per 1000 cubic feet." This seems to be the true idea. It is only doing, for special reasons and on agreed terms, the same thing that Parliament directs to be done upon the occasion of the revision of a gas company's constitution.

As already remarked, one of the chief points of interest in connection with the discussion upon the papers read by Professor Vivian B. Lewes and Mr. A. G. Glasgow was the declaration by Mr. Thos. Goulden of the data of carburetted water-gas making at Beckton. This portion of Mr. Goulden's generally interesting remarks was more weighty than his criticism of Professor Lewes's statement of the results of working his carburetted hydrogen process, because it is clearly illogical to treat the production of a confessedly imperfect experimental plant as on all fours with the performance of an established plant for making 4,000,000 cubic feet of carburetted water gas per day. In the course of the discussion, every process of carburetting coal gas or making carburetted water gas

now engaging the attention of gas engineers throughout the United Kingdom came in for notice, so that our report is a mine of information on many aspects of the general question; albeit, as we have already had occasion to remark, the advantages of carburetted water gas as a "stand-by" in British gas-works were strangely overlooked by many speakers until this consideration was done justice to by Mr. M'Minn, on the inquiry of Mr. Browne. One of the great features of the discussion was the good-humoured, but quite serious, duel between Mr. Glasgow, who is the champion of the best-accredited system of making carburetted water gas as in the United States, and Professor Lewes, whose powers as a controversialist need no qualification here. It was a great treat; and the conclusion was only reached after each partisan had duplicated his original contribution to the Transactions of the Institution. And even then, efflux of time rather than exhaustion of matter stopped the animated discourse.

Mr. Glasgow began by reciting the triumphs of the Lowe system in the States; but he observed that he did not wish to depend upon American evidence. In this he was wise; for although the acceptance of the Lowe system by 350 Gas Companies in the States doubtless means something, it is hard to say what it really does mean. The rest of Mr. Glasgow's speech was stuffed with figures; and it is not too much to assert that it made more impression upon the meeting than did his paper. His onslaught upon the leading characteristics of Professor Lewes's gas-generating plant was particularly heavy; and his final references to the fate of the Hanlon and Leadley process was an effective incursion into the enemy's own country. In his reply to Mr. Glasgow and others, Professor Lewes showed himself a master of the subject, not only from the standpoint of the chemist who is on sufficiently easy terms of acquaintanceship with polymers and other odd creatures to speak freely of their natures and behaviour before third parties, but also from the position of the practical gas manager, whose needs he understands, and with whose desires he truly sympathizes. Professor Lewes crammed a great deal into his reply; and not the least pertinent section of his remarks to the question before the meeting was his statement of the case for gas production as distinct from mere enrichment. We could easily paraphrase some of Professor Lewes's statements, and foist the result upon our readers as comment; but we have no desire to indulge in this cheap and easy form of criticism, if it may be so styled. Suffice it to say here that both Mr. Glasgow and Professor Lewes handled their respective cases and those of the opposition with as much courtesy as ability; and both managed to speak very plainly upon important points, without conveying into the discussion the faintest hint of prejudice. It was a model performance, and a memorable one; and it would of itself redeem the reported Transactions of any technical society from the reproach of being commonplace. And the issue of it all? Well, just for the present, this may be most conveniently described as "drawn"—honours divided.

The Birmingham Gas Committee and the Corporation.

THERE was no discussion worthy of the name, or of the subject, on the report of the Birmingham Corporation Gas Committee to which reference was made in our last issue, when it came before the City Council for adoption this day week. As we anticipated, Alderman Pollack, the Chairman of the Committee, had some further explanations of the accounts to offer; and he confessed with praiseworthy candour that the subsidy to the rates has only been provided by dint of a most arduous struggle, involving the temporary suspension of the usual provision for maintenance and renewal of works, and also of the customary contribution to the sinking fund. This is all very well for once; but it is not sound financing. Whatever it has been customary to spend upon repairs and maintenance and to pay into the sinking fund has been settled, we take it, in accordance with the principles of prudent municipal gas-works administration; and the custom must be restored as quickly as possible. Last year the Committee had to choose between upsetting their accounts and pinching the works or putting another 2d. per 1000 cubic feet on the price of gas; and in a somewhat time-serving spirit they preferred the former course to the latter, which would have exhibited the fact, of which they assume the Birmingham public to be ignorant, that the annual subsidy paid out of the gas "profits" towards the rates does not come out of nothing. It is idle, however, to harp upon this string, and more to the point to recognize that the Birmingham Gas Committee have turned the corner, in their own peculiar fashion, and may now look forward to a more prosperous year. Coals are cheaper—indeed, some recent contracts that we have heard of have been fixed at the lowest prices ever paid; and if Birmingham does not profit to the full from the easier coal market, it will be unlike the way in which the business of the city is generally done. Coke will, however, in all probability, be a drug; and it is impossible to think that the value of residuals can improve. The discussion on the report and accounts terminated with an explanation on the subject of workmen's holidays; and the Labour members of the Council unwisely tried a fall with the Committee, with the avowed object of getting more time for the winter hands, only to make it clear that the Committee have the full confidence of the Council.

Engineers Should Assert Themselves.

IT reads curiously when, scanning a technical periodical, one stumbles upon the declaration that "the engineer "should assert himself." Some people may entertain the notion that engineers are not backward in putting themselves in evidence as important and indispensable members of a modern civilized community; but really, when the matter is looked into, there is some justification for the belief that, as a rule, they are not a sufficiently assertive order of men. They let things slip in a way that no lawyer and few physicians, to cite no other professions, would be guilty of; and stand aside while others occupy positions originally appropriated to them. It is matter of notoriety how the engineering element has been eliminated from the constitution of the Metropolitan Gas Referees, in contravention of the Act of Parliament under which this important body has its being. The same thing goes on elsewhere, in the same way. For example, when an Act for the establishment of a Board of Railroad Commissioners was passed by the Legislature of Massachusetts, it was understood that the Board should be composed of one lawyer, one business man, and one engineer. It was not long before the engineering element disappeared from this Board; the place being taken by a lawyer. It has been well asked: What would the legal profession have said and done if the position had been reversed, and another engineer had supplanted the lawyer? The fact is that the engineer is too often content to be at the beck and call of lawyers, commercial men, and even men of abstract science. He allows these gentlemen to take precedence of him; and nine times in ten will sooner plunge into his works or his drawing office than attend meetings, make speeches, or do any of the other things that lead to power and notoriety in a democratic community. If engineers were to assert themselves more, they would not be so commonly overlooked when important offices, honours, and distinctions of a national or municipal character are being given out; but how the work of the world would go on under such altered conditions it is not easy to see.

Trade Unionism Exhibited at Chicago.

THE opening of the Chicago Exhibition has been generally reported and discussed in the press, and it has come to be generally understood that this tremendous effort of American enterprise, which surpasses in so many respects all previous attempts of the kind, is also distinguished for unprecedented unreadiness on the date fixed for its inauguration. Many reasons exist for this regrettable, but hardly unexpected circumstance, not the least in importance being the difficulties put in the way of the management by the constant cropping up of the question of Union labour. The subject arose into prominence at the first starting of work for the Exhibition; and an agreement was entered into as between the authorities and the Building Trades Council, by which the former bound themselves to recognize the eight-hour day (with overtime in view), minimum society rates of wages, and arbitration on all differences. The Trades Council tried to obtain the monopoly of the work for society men; but they failed in this—as the point always will fail—and were content to leave matters with the distinct understanding that the Exhibition management should be at liberty to employ competent labour of any kind, regardless of Union membership. Having obtained as much as they could expect by way of general conditions of employment, it might naturally be supposed by innocent philanthropists

that the Exhibition workmen would be quite content to go on gathering the golden harvest provided by the lavish expenditure of the Exhibition Committee; but those experienced in industrial matters will not be surprised to learn that the facts were widely different. So soon as the break-up of the wintry weather called for an effort to be made for completing the buildings, the men began to afflict the Administration by repeated strikes and threats to strike. Much critical time was lost in this way; but the Exhibition authorities held by their part in the agreement, and consistently gave the workmen the benefit of every doubt. In all cases where a demand for increased wages has been made, and there has been any reasonable cause for allowing the increase, it has been given. Did the painters, seeing that their time was come, apply for pay after the rate of 40c. per hour? The Administration gave them 45c. rather than have any suspension of work. This amiability encouraged the carpenters to try their luck in the same way, with the added demand that all non-union men should be immediately discharged. The authorities declined to give way; and the carpenters forthwith struck. There was, however, this much of method in the men's madness, that, knowing how short a period of high wages remained to them, the strikers on one job merely took themselves off to another, and worked for some contractor. When demanding the discharge of the non-union men, the Union did not offer to supply their places with society men, although it was known that the authorities were employing every carpenter they could get. The trouble would have been confined to the carpenters, however, if the "walking delegates" of all the Unions had not seized upon the opportunity for stirring up discontent among the members, asserting that a "great principle" was at stake, and that the Exhibition authorities wished to "smash the Unions." It was the same old story, and it ended in the old way. After a great parade of consultation, the Trades Council threatened a general strike unless the employers acceded to their demand; and as the Exhibition Committee, notwithstanding the pressure upon them, stood firm, the Union officials persevered, and managed to keep about 7000 men from working for one day. Next day the Union gave in, and promised good behaviour for the future; but the time lost could not be recovered. Having such difficulties to contend with, the marvel is that the authorities have been able to get on with their work at all, not that they should have been behindhand on the opening day.

The Cardiff Appointment.—Mr. G. F. Brown, Chief Foreman under Mr. Henry Hack, at the Saltley Gas-Works, Birmingham, has obtained the appointment of Manager of the Grangetown works of the Cardiff Gas Company, under Mr. H. Morley, the Chief Engineer, which was lately advertised in the JOURNAL.

Settlement of the Hull Dockers' Strike.—Owing to our going to press earlier than usual this week, and to the demands upon our space for other matters, we cannot do more than record without comment the termination of the strike of the Hull dockers, which was announced on Saturday as the result of an agreement concluded the previous day between the employers and the men's representatives. As the whole of the employers' conditions have been accepted, and the freedom of the port from Union domination is assured, the word "agreement" in this case is synonymous with surrender by the Union. The terms now accepted by the men might have been had at any time during the strike, the complete failure of which is the most disastrous blow the cause of the so-called New Unionism has received since the South Metropolitan affair.

Gas Managers and Ambulance Work.—We have on previous occasions referred to the value to gas managers of an acquaintance with ambulance work, and of a knowledge of the best means of rendering prompt aid to injured persons. An example has lately been brought to our notice from North Wales. A little boy, under four years of age, while playing with some companions, fell into a pool abutting on the Bagilt Road, and adjoining the bleaching-house of a paper-mill. An alarm having been raised, Mr. W. Williams, porter at the Holywell Railway Station, who was passing at the time, pluckily jumped into the water, and, after an ineffectual attempt to find the child, eventually succeeded in drawing him out with the aid of a hook procured from a neighbouring blacksmith's shop. Just as Williams was handing the boy, limp and lifeless, to the bank, Mr. H. B. Chamberlain, the Manager of the Gas-Works, and Police-constable Davies, members of the St. John Ambulance Association, reached the spot; and they forthwith took the boy in hand. Adopting Dr. Sylvester's method of restoring animation, they were rewarded, after a quarter of an hour, by the appearance of a slight sign of animation; and in half an hour regular respiration was restored.

WATER AND SANITARY AFFAIRS.

THE Special Water Committee of the London County Council have drawn up a report which may be described as almost too candid in its outspoken audacity. The Committee wish the way to be kept open for the introduction of a comprehensive scheme by which the Council may deal with the whole of the Metropolitan Water Supply. Such a scheme is not yet prepared; but the Committee say they are using every effort to collect the requisite materials. In the meantime, the world must stand still, and await such deliverance as the Council may be able by-and-bye to accomplish. Precautions must be taken to prevent any substantial enlargement of the capital value of the Companies, "or of their means of "supply." This consideration is said to be of imminent importance, in view of the fact that "the existing "resources of the Companies are strained to the utmost." The report proceeds to explain that "the constantly "growing demand of the Metropolis for an increased "supply of water renders the provision of an additional "source, from some quarter or other, almost immediately "necessary." Under such circumstances, who could oppose the Companies, if the latter sought to fulfil their obligations, and to maintain an adequate supply? That the Companies will make an effort of this kind is what the County Council expect; and it is anticipated that at least some of them will speedily ask Parliament for additional powers. "Such a demand," the Committee say, "considering the necessities of the case, might be "difficult to resist." The will to do so is not wanting; but the way is not clear. London must have water, let who will supply it. The only plan which the Special Water Committee are prepared to recommend is that the Council shall step in, and undertake to meet the coming want. This is to be done, not out of love to the consumer, but in fulfilment of the reckless policy by which the undertakings of the Water Companies are to be starved and depreciated. Hence it is recommended that the Parliamentary Committee be instructed to prepare a Bill for introduction in the session of 1894, "to empower "the Council to provide a supplementary supply of water "for the County of London." Could anything be more vague and mischievous? Where is the supply to come from, and how is it to be introduced? Will the County Council supply the Companies in bulk, somewhat after the manner proposed by Mr. Webster, of Rickmansworth? Or do they dream of laying down an independent system of mains? Are they going to intrude into the outlying districts of the Companies, so as to supply new comers with water, and exclude the Companies from doing so? There is a loophole already in the East London district. By the rejection of their Money Bill in the present session of Parliament, at the instance of the County Council, the Company find all their capital either expended or required for works already ordered. A new neighbourhood has become populated; and a request is made for the Company to supply it with water. But the Company are without the requisite capital; and they are obliged to refuse the application. This is simply a breakdown in the existing system. The Company are under legal compulsion to supply the water, and are at the same time disabled from doing so. Here is a chance for the County Council. But at what a cost. As for the dual supply, London will never consent to it. Neither can Parliament break faith with the Water Companies by permitting actual competition. The Companies have done their duty, as proved by official returns; and there is no doubt that the report of the Royal Commission will say as much. The Special Water Committee of the County Council are troubled at the prospect of the Royal Commission report. It may "render modifications neces-"sary hereafter;" and we think most likely it will. The discovery of the lower greensand in Windsor Forest, yielding a strong spring of water at a great elevation, is just announced, and is more likely to help the cause of the Companies than that of the Council. But a Bill of any kind, emanating from the Council, means further expense and disturbance to the Water Companies, who are simply harassed from year to year by inquiries and projects for which the Council are mainly responsible. It will be to the advantage of the consumers, as well as that of the

Companies, if the Royal Commission can virtually put a stop to this costly and stupid crusade.

Renewed attention is being called to the state of the Manifold Ditch, as affecting the waters of the Lea; and the suggestion is made that, in the event of cholera occurring at Hertford, the health of London would be menaced through the intervention of the water supply furnished by the East London Company. Nine years ago, the Manifold Ditch was the subject of a lawsuit; the Lea Conservancy seeking for an injunction to restrain the Hertford Corporation from causing or permitting sewage, or anything of that nature, to escape from that city into the river. After a prolonged trial, in which the Water Company expended £8000 in support of the suit, Mr. Justice Williams gave judgment against the Conservators, with costs. This decision was arrived at, after the Judge had visited the ditch, so as to test the evidence of the witnesses by his own observation. Possibly the ditch was not then as it is now, or as it was the other day, when report spoke against it. The judgment given was very emphatic; the Judge declaring that "no real injury, pollution, or "nuisance" had been caused by the Corporation of Hertford to the waters of the Lea. Recent investigation rather favours this conclusion, though the liquid in the ditch is declared to be so black and offensive as to resemble sewage rather than a reasonable effluent. The ditch empties itself not exactly into the Lea, but into a kind of byway, where the flow of the water is checked by the Ware Lock; and the spot becomes little better than a pool. At a point lower down, the main stream presents itself, and is soon able to dispose of such pollution as comes from the byway or "loop line." The statement that the river "for a long distance from the point of dis- "charge is altered in colour and offensive in appearance," is clearly an exaggeration. But while the river, in its long sinuous flow, effectually overcomes the malign influence of the Manifold Ditch, so that the water distributed from the works of the East London Water Company compares favourably with other portions of the Metropolitan supply, this ugly ditch gives occasion for evil surmise. It may not be generally known that, to remove all pretext for complaint, the East London Company have negotiated with the Hertford Corporation in past years, for the purpose of taking over the sewage works and carrying out an effective process. That the ditch can be purified there is no possible doubt, and that the Company would soon compass this result is equally certain. But a new difficulty now presents itself, to which attention has not been drawn. Sewage purification costs money; and the East London Company have none to spare—thanks to the action of Parliament under the tutelage of the London County Council and the wire-pulling energy of Mr. John Burns. Unless the Hertford Corporation take alarm, and proceed to deal effectually with the sewage of their city, the Manifold Ditch will remain as it is; the only consolation in the meantime being that the London water supply does not appear one microbe the worse. It is, in fact, many years since the River Lea presented so bright and healthful an appearance as it does at the present time, excepting that part which lies below the storm overflow of the London main-drainage works, which is several miles farther down stream than the source of the East London supply.

There would be cause for regret if the majority of those who administer the finances of water undertakings took the same view as that adopted by the majority of the Bolton Town Council. A hand-to-mouth policy is always to be condemned where any more prudent method of administration is possible; and the advisability of building up a strong reserve fund is beyond all reasonable question, whether water-works are in the hands of a company or of a corporation. The policy of Parliament in this respect may be sufficiently gathered from the provisions of the Water-Works Clauses Act, 1847, in regard to the formation of reserves. The uses to which such a fund may be put can be learned from sections 75 to 79 of that Act. Nevertheless, according to the report which recently appeared in the JOURNAL, the Bolton Corporation seem to think it prudent to ignore the danger of extensive depreciation or exceptional calamity. Their capital in the local water-works is £750,000; and yet to meet special contingencies no provision is made. With scores of miles of pipes which have been in the ground for many years t cannot be held that an addition of £1500 to the renewal fund is anything like an adequate provision.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 10 & 11, 1893.

Mr. JOHN METHVEN, Assoc.M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

In the JOURNAL last week we reproduced the first four papers read at the above meeting. We now give the remainder, with the discussions on the papers of Mr. G. Livesey, Professor Vivian B. Lewes, and Mr. A. G. Glasgow.

THE APPLICATION OF WELDON MUD TO GAS PURIFICATION.

By J. J. HOOD, D.Sc., Assoc.R.S.M., and
A. GORDON SALAMON, Assoc.R.S.M., F.I.C.

Some few years since, we introduced to the notice of the gas world a material prepared from what is known to the alkali industry as Weldon Mud, a compound consisting essentially of hydrated oxides of manganese. We then ventured to predict that it would, in view of its great oxidizing properties, prove of value in the removal of sulphuretted hydrogen from coal gas. The experiments upon which our remarks were founded had mainly been conducted in the laboratory; and it remained to ascertain whether the promise held out by these experiments would be fulfilled in their practical application upon a large scale. In the interval, we have been afforded exceptional facilities for testing this question, and have derived our experience from the employment of a very large quantity of Weldon Mud—about 8000 tons being now in use. From the results to hand, we feel justified in asking the further attention of the general body of gas engineers to a consideration of the claims of this new purification adjunct; and we desire to acknowledge the honour accorded us by the invitation of the President and Council of this Institution to place before you our views on the subject.

Of the total sulphur present in coal employed for gas making, about one-half passes forward into the purifiers; and of this, even when oxide of iron or Weldon Mud is employed for its absorption, a large proportion is retained in the lime together with carbonic acid—its presence, in conjunction with a small quantity of ammonia, accounting for the foul-smelling spent lime. This portion of the sulphur is unrecoverable. The sulphur not retained by the lime, but passed forward into the oxide of iron, by which it is absorbed, can only be regarded, commercially, as pyritic sulphur applicable to produce sulphuric acid.

Considering the natural distribution of pyrites as compared with native sulphur or brimstone, one cannot but recognize the fact that the former must always command a lower price than the latter; and in view of the large quantities of sulphur which it is within the power of the gas maker to collect, there can be no doubt that an important economy would be effected by recovering the sulphur that exists in coal gas, and selling it in the form of brimstone. The chemical properties of Weldon Mud justified our conviction, at the laboratory stage of our experiments, that it would be possible to recover the whole, or at least the greater portion, of the absorbed sulphur as brimstone; and we are now in a position to state that this can be done upon a working scale—a small plant having been erected for dealing with considerable quantities. We invite your attention to the samples exhibited to-day of specimens of brimstone and also of flowers of sulphur of high purity, extracted from Weldon Mud, employed upon the large scale in the purification of London coal gas; and we would add that immediate steps are about to be taken to permit of the production of sulphur in the form of brimstone from all the spent Weldon Mud employed in gas purification.

We submit, as a great recommendation of Weldon Mud, that the spent material can be regenerated upon an economical basis for further use in gas purification; and the samples of sulphur to which we have directed your

attention are extracted in the normal course of the regeneration of the material. Theoretically, there should in this process be no loss of the manganese constituents of the Weldon Mud. It is worked through a cycle—viz., manufactured; next employed in the removal of sulphur; and, when sufficiently saturated, submitted to regeneration. During this latter process it parts with all its sulphur, and as a result of the regeneration is restored to its original condition, and is ready for further use by the gas maker. Its regeneration being economical, we feel ourselves in a position to assert that it will be found, when worked under the best conditions, to compare favourably in price with other gas-purifying materials.

Our preliminary experiments with Weldon Mud justified the assumption that in it would be found a sharp and powerful absorbent of sulphuretted hydrogen, and that the sulphide of manganese resulting from such absorption could be revivified *in situ* by the admission of a regulated sufficiency of air. We have now to discuss whether these conditions are obtainable in practice, and, above all, the economics of their application. Fortunately in this connection we are permitted to refer to the experience of those prominent gas engineers from whom we have obtained so much assistance; and before proceeding to state the figures with which they have supplied us, we desire to record our sincere thanks to Mr. G. C. Trewby, Engineer-in-Chief to The Gaslight and Coke Company; to Mr. Methven, your President, and Engineer at Beckton; to Mr. Beale, Mr. Goulden, Mr. Lacey, and to Mr. Reeson, the present Superintendent of the Purification Department at Beckton; also to Mr. Horton, Engineer at the King's Cross station of The Gaslight and Coke Company; to Mr. Cash, the Manager and Chief Engineer of the Brighton and Hove General Gas Company; and to Mr. C. C. Carpenter, a member of your Council, and Engineer at the Vauxhall works of the South Metropolitan Gas Company. It is our duty to state that, but for the assistance and encouragement received from these gentlemen, it would have been impossible for us to have appeared before you to-day.

We do not propose to dwell at length upon the details of the reports with which we have been furnished, but, by stating their result in general terms, to enable every gas engineer to judge for himself as to the possible value to him of Weldon Mud.

The removal of sulphuretted hydrogen from coal gas has to be considered from two aspects—that in which mere traces have to be removed from gas that has been practically purified, and that in which large quantities and sudden bursts of sulphuretted hydrogen, driven into the material, have to be dealt with. Thus, we have the two positions in the purification series—namely, the catch or check-vessel position, and the forward or oxide position. In the suggestions which we shall presently offer, it will be seen that, in future working, we desire substantially to abandon the check-vessel position, and that the check and oxide vessels should be practically merged. But as these suggestions have not yet been carried out upon the large scale, we purpose dealing with that which has been achieved, subject to the expression of our conviction that much greater economy is still to be secured.

It was to the check-vessel position that our attention was first directed at Beckton, because it was found that, notwithstanding the very minute traces of sulphuretted hydrogen gas (say, 10 to 15 grains per 100 cubic feet) entering these check-vessels, it required a material of very great affinity for sulphuretted hydrogen, and one extremely sharp in its action, to allow of clean gas passing into the holders. Both lime and oxide of iron had been previously employed at Beckton for this purpose. But it was found that the oxide of iron was not sufficiently active to remove the very small trace of sulphuretted hydrogen from the large quantities of coal gas which were passed through the vessel during the day; and thus it came that lime, the more powerful base, completely supplanted oxide of iron in this position. Not so, however, in all works where less gas is made; for at Brighton oxide of iron had for long been employed as a check-vessel material. We have, therefore, had the advantage of testing the merits of Weldon Mud in the check-vessel position against lime at Beckton, and against oxide of iron at Brighton.

At Beckton, the result of the past three years' working affords us a complete record, and shows the exact nature of the saving effected. At Brighton the full saving has not yet been ascertained, because the Weldon Mud employed in this position is not yet exhausted. It has been found, in working the check-vessels at Beckton with Weldon Mud, that, given the introduction at the inlet of the check-vessel of about ¼ per cent. of atmospheric air, the Weldon Mud will continue in active efficiency for a period ranging over from two to three years. It is, however, considered by Mr. Methven that so long a continuance in action without raising the lid of the vessel is not advisable, because of the necessity of cleaning the mains from naphthalene and other accumulated impurities. Therefore the figures which have been supplied to us deal with the retention of Weldon Mud in the check-vessels for a period of one year. Such working shows that, previous to the employment of Weldon Mud in the catch-vessel position, for every 100 million cubic feet of gas purified, 210 yards of lime had to be shifted; whereas by using Weldon Mud in the same position, only 12·7 yards of Weldon Mud had to be moved for the purification of a similar quantity of gas. Thus, apart from all other considerations connected with wear and tear of plant, loss of gas, pressure of material, &c., the labour charges for lime as against Weldon Mud were in the ratio of 16 to 1. It is quite unnecessary to dwell upon these figures, beyond saying that they speak for themselves to such an extent that during the last two years lime in the check-vessel position has been entirely supplanted at Beckton by Weldon Mud.

Respecting the relative merits of Weldon Mud and oxide of iron in the check-vessel position, we cannot do better than quote the report furnished to us by Mr. Cash. It is as follows: "Weldon Mud displaced oxide of iron in catch purifiers at Portslade in March, 1891. One catch purifier is used on each section now instead of two, which we found necessary when oxide was used. In No. 1 section the catch has had 768 million cubic feet through it; and has been in action since July 1, 1891, and is still clean on outlet. In No. 2 section a similar purifier has passed 718 million cubic feet, and is still clean on outlet. Both these purifiers show for a still further duty; and till it be reached, the question of cost cannot be ascertained. Oxide of iron in the same position gave an average life of 60 million cubic feet per charge; therefore Weldon Mud has already shown a duty of twelve times that of oxide per charge."

To these statements it is only necessary to add that, when used in the check-vessel position, the pressure thrown by the Weldon Mud rapidly diminishes, until it becomes practically *nil;* whereas it is well known that lime throws a considerable pressure, which does not diminish, and that oxide of iron likewise throws a pressure which increases as the material becomes saturated.

The forward or oxide purifier has necessarily to remove much larger quantities of sulphuretted hydrogen gas. The amount may be taken as ranging from 200 to 2000 grains per 100 cubic feet; and it is when this latter quantity is about reached that it comes forward into the vessel in a burst, taxing to the utmost the absorptive powers of any purifying material. In order to deal with these large quantities of sulphuretted hydrogen when Weldon Mud is the absorbing agent, we perform the revivification continuously by injecting a small percentage of air with the gas, instead of taking the material out of the purifying vessels and exposing it to the atmosphere, which involves much labour and consequent cost in working. In order to revivify *in situ*, it is necessary that the material should have so strong an affinity for oxygen as to combine with it energetically as it passes through with the gas. It is found that some purifying materials are sluggish in this respect; and in such a case revivification *in situ* becomes an impossibility. It is found in practice that about 1 per cent. of air should be introduced into the Weldon Mud along with the gas, when dealing with such comparatively large bursts of sulphuretted hydrogen as above-mentioned; and the revivifying effect of this quantity is such as to keep the Weldon Mud efficient over a long period of time. It may, however, become necessary, as the Weldon Mud gets more and more saturated, to put the vessel out of action, then open the air-valves, and pass through a much larger amount of air. When this is done, the temperature of the material must be closely watched; otherwise the heat developed will be so great as possibly to burn the grids or ignite the sulphur. When attention is paid to the rise of temperature, and the air supply regulated accordingly, no

such danger is to be apprehended. It should be added that the nitrogen introduced by the continuous admission of 1 per cent. of air in this position has not been found to perceptibly prejudice the illuminating power of the gas.

It is in this way that Weldon Mud has been worked in the forward position at Beckton, at King's Cross, and at other works; and the results realized would seem to be extremely satisfactory. Thus we learn that at Beckton, when using oxide of iron in this position, for every 100 million cubic feet of gas purified, 503 yards of oxide of iron have to be shifted; whereas with Weldon Mud in a similar position, for every 100 million cubic feet of gas purified, slightly less than 50 yards have to be moved. From this it follows that, in working Weldon Mud in the oxide position, only one-tenth of the labour is entailed to that necessary when oxide of iron is employed. These figures, which are also furnished us from Beckton, carry their own conviction as to the extent of the economy which can be effected in this position by the substitution of Weldon Mud for oxide of iron. It will not be forgotten that it also involves a very great diminution in the wear and tear of plant and in the loss of gas. The data obtained by Mr. Horton, of the King's Cross works, based upon an experience of Weldon Mud in the oxide position extending over more than a year, point to almost an identical result. We are permitted to assert that this gentleman has permanently adopted Weldon Mud as the desulphurizing agent of his gas-works, pending the appearance of a better material.

Your members will be familiar with a paper recently read by Mr. Carpenter before the Southern District Association of Gas Engineers; and as it is so recent, and comprised his experience in the use of Weldon Mud up to the time of the publication of his paper, we cannot do better than refer to it for an expression of his favourable opinion respecting the employment of Weldon Mud.*

Thus far we have shown how Weldon Mud may be advantageously employed according to present practice; but we now purpose going a step further, by suggesting how gas purification should, in our opinion, be modified so as to permit of Weldon Mud being used with still greater benefit.

We have hitherto only spoken of the advantages attaching to purification by means of this material. It is only right that we should allude to certain occurrences in connection with it which, unless obviated, might be regarded as drawbacks. If the Weldon Mud be in a position where condensation of moisture under existing conditions is a matter of certainty, it will, by virtue of its physical structure, absorb the water thus condensed, and when saturated may have to be taken out in a wet and sloppy state. If the mud thus removed be spread in thin layers, and freely exposed to the action of air, it will dry, and can be broken, damped, sieved, and replaced in the vessels, and in such a case will be active for further sulphuretted hydrogen absorption. It must, however, be admitted that the necessity for this drying and revivification is unsatisfactory; and it would no longer exist if the undue condensation above alluded to could be prevented.

In cases where the calcium sulphide vessel, employed for absorbing the carbon bisulphide, is placed after the Weldon Mud, when the latter is in the advanced or oxide position, and air is employed to the extent already indicated, it has been asserted that the life of the sulphide vessel is diminished; and it is supposed that the slight trace of air possibly unabsorbed by the Weldon Mud escapes into the sulphide vessel, and that the gradual formation of hyposulphite of lime destroys the power of the sulphide vessel for carbon bisulphide absorption. We do not agree with the explanation; but we are strongly of opinion that the sulphide vessel should be removed from such a position because of other advantages which could thereby be gained.

In order to meet the difficulties which we have pointed out, and others to which we shall presently allude, we have devised a scheme of gas purification, based upon chemical considerations and laboratory experiments, to which we now invite your attention. The experiments upon which the scheme is founded, though long continued and varied in many ways, can scarcely be considered as being at present beyond the laboratory stage. This notwithstanding, we hesitate to neglect this opportunity of bringing it to the notice of gas engineers; for we have only dealt with it upon the chemical side, and we think that it remains for gas engineers to find the best method of applying it in practice. In carrying out these experiments, we have found ready co-operators in Mr. Cash and Mr. Carpenter, who have in the most liberal manner placed their works and their experience at our disposal. Again we have to state how deeply we are indebted to those gentlemen for the facilities they have afforded us.

As a general rule, the removal of the impurities contained in coal gas takes place in the following order: Carbonic acid, sulphuretted hydrogen, carbon bisulphide, and finally the last traces of sulphuretted hydrogen. Apart from the main bulk of the sulphuretted hydrogen which is absorbed, as already mentioned, by oxide of iron or by Weldon Mud, we may regard lime as the purifying agent for the removal of these materials; and the result of the passage of the gas through lime is the production of carbonate of lime, sulphide of lime, and what is termed thio-carbonate of lime.

It will be recognized that, in the production of each of these three compounds, chemical changes have to be effected between the lime and the impurities contained in the coal gas. And it will be granted that in the practical operations of the gas maker they are brought about at the ordinary and frequently varying temperature.

Having regard to the fact that heat is so important a factor, not only in promoting chemical change, but also in modifying the final product, it would at once appear that the conditions necessary to the production of the three compounds above specified are capable of much variation, in such a way as to produce a good, indifferent, or bad result. This consideration receives further emphasis when we separately consider the nature of each of these three compounds.

It is known that two different carbonates of lime exist in Nature—the one called calcite, the other arragonite. These two substances are identical in chemical composition; but they differ widely in their physical properties and in the energy of their chemical behaviour. In crystalline structure they are quite unlike, and, indeed, belong to different systems of crystallization. It has already been observed that, if carbonic acid gas be passed into a cold solution of lime water to saturation, that form of carbonate of lime known as calcite will result; whereas if the gas be similarly passed into a hot solution of lime water, crystals of arragonite will be produced. Similarly, there is reason to believe that there are various sulphides of lime; and the probability of their existence is already turned to practical account in other branches of chemical industry. Thus a sulphide produced with hot lime would appear to be altogether different in its properties to a sulphide produced under conditions of cold.

It is known that if a mixture of carbonic acid and sulphuretted hydrogen be caused to act upon slaked lime, the sulphuretted hydrogen will first combine with the lime to form sulphide, and that the sulphuretted hydrogen thus combined will, in turn, be expelled by the carbonic acid, with the formation of carbonate of lime. We have found that the energy of expulsion of sulphuretted hydrogen from sulphide of lime is very largely conditioned by the temperature of the sulphide, and of the temperature at which it was formed—that is to say, a combination of lime and sulphur may be formed which is easily destroyed by carbonic acid passing over it; whereas under different conditions a combination is formed in which the sulphuretted hydrogen is not readily expelled by carbonic acid gas. In fact, the stability or instability of the sulphide of lime, as measured by the action upon it of carbonic acid gas, depends greatly upon the temperature at which the sulphide is formed and maintained. If the formation or fouling takes place in the cold, it is a sluggish expulsion, and is not sharply or completely performed. If, on the other hand, the lime is fouled with sulphuretted hydrogen, at a temperature ranging between 90° and 100° Fahr., the expulsion may be substantially complete, and that which is left consists almost wholly of pure carbonate of lime. When the operation takes place in the cold, and the expulsion, as above mentioned, is sluggish, the carbonic acid is not wholly absorbed, nor is the sulphur wholly expelled from the lime. In such a case the carbonic acid and the sulphuretted hydrogen travel together through the lime; and it is found impossible to obtain anything approaching pure

* See JOURNAL for Feb. 14 last (p. 273).

carbonate of lime as a final product, or one which does not contain a large proportion of sulphur.

According to the present system of gas purification, a small amount of carbonic acid, which under existing circumstances always accompanies sulphuretted hydrogen, is constantly eating its way into the sulphide vessel which has been made with a view to the formation of the thiocarbonate by union with carbon bisulphide. The result of this gradual and continuous action of carbonic acid is to impair the efficiency of the sulphide vessel, and gradually to render it useless. Lime purification, being always conducted in the cold, favours, as we have already indicated, the introduction of small quantities of carbonic acid into the sulphide vessel; and hence it is that sulphide vessels, as now formed, have so small an efficiency and so short a life, when we consider the chemical work which they are called upon to perform in the removal of so small a proportion of carbon bisulphide, and the relatively large mass of calcium sulphide which it is assumed is devoted to the purpose of carbon-bisulphide removal. Apart entirely from the question of freedom from carbonic acid (which gas is the enemy of sulphide vessels), we have found that just as the energy of union is keener and more complete for carbonic acid gas when the lime is hot, so also do we find that the energy of union as between calcium sulphide and carbon bisulphide is sharper and much more complete when the sulphide is prepared from hot lime, and is maintained at about the temperature of 70° to 80° Fahr.

We have also proved that the amount of carbon bisulphide which can be removed from coal gas, previously freed from carbonic acid gas, is very much greater in the case of a sulphide prepared with hot lime than with one fouled when the lime is in a cold condition. In proving this point experimentally, it was necessary to take precautions against the evolution of heat due to sulphuretted hydrogen impinging upon slaked lime. To this end, sulphuretted hydrogen was largely diluted with hydrogen, and introduced into a vessel filled with cold slaked lime, which was surrounded with ice and salt. The mixed gases were slowly passed through the lime until sulphuretted hydrogen appeared freely at the outlet. Similarly, a sulphide was made with lime which was slaked and introduced into the vessel while still hot. Pure sulphuretted hydrogen was then passed through the lime until it blackened lead paper at the outlet. The sulphide made with hot lime absorbed all the carbon bisulphide but about 2 or 3 grains, and was found to possess an efficiency of fully 30 per cent. over that of the cold lime. We believe that this difference could be rendered still more marked if the dilution of the sulphuretted hydrogen with hydrogen had been greater.

By suitably preparing a hot sulphide vessel—that is, by passing pure sulphuretted hydrogen gas through hot slaked lime—we find that it is quite easy with our vessel to remove 40 or 42 grains of carbon bisulphide from coal gas containing about 45 grains, provided that the latter be free from carbonic acid; and we are of opinion that the failure to remove the remaining few grains is due, not to want of chemical activity in the sulphide, but to slight creep or other physical conditions. We see no reason why, with a sulphide thus prepared upon the large scale, a similar result should not be forthcoming.

It has often been asserted that bursts of sulphuretted hydrogen injure sulphide vessels; but our experiments point in an exactly opposite direction. If a sulphide vessel be prepared with hot lime, so as to give an efficiency of (say) 40 grains, we find in every case that it makes practically no difference whether the sulphuretted hydrogen of the crude gas passes through the sulphide vessel or is removed prior to the introduction of the carbon bisulphide. We do find, however, that a very small quantity of carbonic acid gas materially influences the efficiency of the vessel; and we think that in every case in which sulphuretted hydrogen is believed to be prejudicial to the life of a sulphide vessel, it is due to the destructive action of carbonic acid, with which it would appear to be invariably associated. In order to lay stress upon this point, which is of the utmost importance, we may add that we repeated the experiments many times, and never observed any injury to the efficiency of the sulphide vessel arising from the presence of large quantities of pure H_2S

Now, if a hot sulphide vessel be prepared as above stated, so that it shows an efficiency of say 40 grains, we have found that by chilling the sulphide vessel this efficiency can be reduced to *nil*. Thus if a vessel giving such a duty be surrounded with ice and salt for several hours, this reduction of duty will at once become apparent. It may be here pointed out that this condition often obtains in practical gas purification, where the sulphide vessel is exposed to the action of frost in winter, and the duty falls off when most wanted at a maximum.

If the chilled sulphide, the efficiency of which is thus destroyed, be now surrounded with hot water at a temperature of about 150° Fahr., it will be found that after a few hours it will again become efficient; but we have never been able to impart at this temperature more than about 50 per cent. of its original duty to a sulphide vessel thus chilled, and in some cases not anything like so much.

In a series of experiments made with equal weights and volumes of hot and cold lime—the former, in addition to being introduced hot into the vessel, being maintained by means of a water-coil at a temperature of about 120° Fahr.—the crude gas was passed into the vessels at equal rates, and the outlet gas was tested for carbon bisulphide every half foot. It was then found that the cold lime vessel gave no duty whatever during the whole of its life for carbon bisulphide, whereas the hot lime vessel developed a duty of about 20 grains soon after sulphuretted hydrogen had been indicated as passing the outlet; and this duty was maintained until carbonic acid was given off, when it speedily fell away to *nil*. It should also be noted that in this and all other comparative experiments between hot and cold lime, the sulphuretted hydrogen was given off much sooner and in much greater quantity in the case of the hot lime than of the cold. In other words, sulphide made with hot lime would appear to be a tender sulphide, easily and completely destroyed by carbonic acid.

We have found that the physical condition of lime largely influences the completeness of the removal of carbonic acid. If the lime be allowed to become dry and powdery, carbonic acid will speedily slip. If, on the other hand, it be too wet, the result is not satisfactory. It is of great importance that both these extremes should be avoided. The powdery condition is soon induced if cold gas be introduced into a hot material; and conversely, there is too much wet if hot gas be introduced into a cold material. It would, therefore, appear to be desirable that the gas and the material through which it is passed should be maintained as nearly as possible at the same temperature, and that the gas should be saturated with moisture at its temperature prior to such introduction.

We may now summarize the results of our experiments in connection with purification by means of lime; and when we mention hot lime, we mean lime freshly slaked and placed inside the vessels as hot as it can be handled: (1) Carbonate of lime may be produced either in the form of calcite or arragonite. The energy of combination as between carbonic acid and slaked lime is much keener and more complete when the temperature conditions are favourable to the production of arragonite than in the case of calcite. (2) By employing suitable temperatures, it is in the power of the gas engineer to form arragonite in his purifying vessels, and not calcite, as has previously been the case. (3) There would appear to be various sulphides of lime. By forming it from hot lime, a tender sulphide is produced which is readily and completely destroyed by carbonic acid. (4) The result of such expulsion is the production of a practically pure carbonate of lime, which may be re-caustified in suitable furnaces, instead of being burned to sulphate of lime, as is at present largely the case. (5) By the complete expulsion from the carbonate vessels of the sulphuretted hydrogen due to the formation of this tender sulphide, the waste of sulphur is limited to that which is left in the sulphide vessel, and the remainder may be driven forward into Weldon Mud and recovered as brimstone. (6) The formation of this tender sulphide ensures a great burst of sulphuretted hydrogen being driven through the lime, with the formation of an efficient sulphide in that portion of the vessel still untouched by carbonic acid. (7) By forming a sulphide vessel with hot lime instead of cold, and with sulphuretted hydrogen gas kept free from carbonic acid, a carbon bisulphide efficiency of about 40 grains per 100 cubic feet with our vessel may be expected.

By aiming at the production of arragonite instead of calcite, and by suitable attention to the conditions which we have formulated, we think that the gas maker will be

able greatly to reduce the number of vessels now required in gas purification. Thus we suggest three lime vessels, all of which should be prepared and maintained hot, the first and second of which should be removable carbonates, and the third a permanent sulphide. The carbonate vessel should be prepared with hot lime, and the crude gas introduced into it. When this is foul, or nearly so, and the burst of sulphuretted hydrogen is being driven out from the second vessel, the preparation of the sulphide vessel with hot lime will then commence. Care should be taken, however, that the sulphuretted hydrogen thus introduced into this hot lime for the purpose of making a sulphide vessel, should be quite free from carbonic acid. The sulphide vessel being made, the first and second carbonates are continued in action until the second vessel shows carbonic acid about half way up; then the first vessel should immediately be changed, hot lime, of course, being introduced. This will give time for the first vessel to be again in working order before the second shows carbonic acid at the outlet. Then No. 2 vessel should become the first in the series; and thus by changing No. 1 and No. 2 alternately, No. 3 can always be kept as a sulphide vessel, and practically a pure carbonate, suitable for re-caustifying, should be produced in No. 1 and No. 2.

The sulphuretted hydrogen will now be driven forward through the sulphide vessel into Weldon Mud, of which there should be two vessels for the main absorption, so that one can, when necessary, be slipped, so that the contained Weldon Mud may be completely revivified by opening the blow-valves, and passing the requisite quantity of air, whilst the other is at work. If desirable, as a precautionary measure, there may also be a check-vessel of Weldon Mud. By this mode of work, not only may all the sulphur be expelled from the lime with the exception of that retained in the sulphide vessel, but the gas will be hot when passing into the Weldon Mud; and thus condensation and the production of a sloppy material will be avoided. No foul-smelling compound should be produced, and gas purification should, we think, be placed upon a sounder and more scientific basis.

It only remains to deal briefly with the method now being worked for the regeneration of the spent Weldon Mud; and we find that this may best be accomplished, with a view to the production of brimstone, by heating the spent mud with sulphuric acid, thereby converting all the manganese into soluble sulphate of manganese, which may be removed from the insoluble and precipitated sulphur by suitable washing. The residue thus left is distilled, and sulphur such as is now exhibited may be produced in a marketable condition.

The solution of sulphate of manganese is next treated with calcium chloride, which is a refuse in several chemical industries; and manganous chloride, together with sulphate of lime, results. The manganous chloride is removed by filtration from the sulphate of lime, and is then re-blown to Weldon Mud, and freed from calcium chloride (which is again employed in manganese regeneration), and prepared in the manner formerly described by us. By this process of regeneration, the gas maker employing Weldon Mud is rendered independent of the alkali industry, upon which we have hitherto had to rely so much—involving us in endless vexation and delay.

The regeneration having been performed by experienced manufacturers with a small plant which we have erected upon a scale sufficiently large to supply the requirements of even a very important gas-works, and allow of a reliable opinion being formed, we are now in a position to state that the whole process is ready for the investigation of gas engineers.

In conclusion, we trust that our remarks respecting the action of lime, and the experiments in connection with it, which, as we have stated, have only reached the laboratory stage, may be corroborated by the experience of gas engineers, and that they may assist us to apply them to their requirements, so that an advance may be made in that phase of gas purification which, as it now stands, can scarcely be regarded in the light of a satisfactory chemical operation.

INCLINED RETORTS AT THE COVENTRY GAS-WORKS.

By George Winstanley.

The following particulars of the introduction into the Coventry Gas-Works of inclined retorts, together with a summary of the lessons taught and experience gained after eighteen months' working, have been compiled in response to the desires of the Council of this Institution. The author set about his task with considerable diffidence, knowing how much had been written and stated for and against the inclined system of retort-settings—sometimes, as he thinks, without sufficient reason and proof on the side of those who make such statements; showing a want of clearly comprehending its significant points and their application, and of balancing the advantages and disadvantages (if there are any of the latter) attending its use. Theoretical reasons against its adoption have been freely used; but, as far as the author can see, no practical reasons have been adduced, nor has there been from teaching in practice a single instance, showing why its introduction into our gas-works should not be more general. Many instances of seeming failures have been freely reported; but the writer thinks these are owing to the requirements necessary in order to arrive at success not being fully grasped. These, however, to his mind, did not point to the system being a wrong one; and they only led him to more eagerly obtain all the information possible, and upon all points connected with the system as far as it had been tried up to about two years ago. Cursory glances were not sufficient. The subject required much thought and examination; and, as a result of this, the writer was able to steer clear of what were considered errors in previous erections.

To all doubting individuals there is open the opportunity of satisfying themselves as to the workableness of this or any other departure from the usual routine as handed down to us, and applied in our gas undertakings. If a trial setting were erected, the experimentalist would be able to settle the conflicting points which may have beset him during his examination and investigation of this system. It has become common to hear many such expressions as these: "With such a system the make of gas cannot be so good." "The illuminating power must suffer from the fact of gas travelling over the hot coke." "Tar must be less in quantity made per ton of coal carbonized." Doubts as to what would happen to charges under various conditions, as to shape of retorts, &c., have been also much commented upon; and to all these queries the writer hopes to return a satisfactory answer.

He may be permitted here to give utterance to thoughts which will trespass upon him during this work, and they are as follows: How the old systems linger, and how tenderly we cherish them, even when we see what can be done by the introduction of new things! If we could but rid ourselves of that feeling of uncertainty which surrounds us during times like these, when it behoves every engineer to look well after improvements which will strengthen his hands, and reduce his expenses as labour costs increase, it would not be left to a few to fight out uphill problems; but the army of seekers after good and useful things would be greatly increased, doubts would be settled in a practical way by each, theoretical ideas would vanish, and an easy working state of things would ensue.

Having followed very closely the march of events connected with the working of this system, feeling certain that there was much good in it, and grasping the points where failure had occurred, the author decided to introduce the system into his works in the shape of a trial setting. This was done by converting an existing arch (one of a number standing together) and putting into this arch, which was 7 ft. 6 in. wide, six Ω-shaped retorts 15 feet long, and 22 in. by 16 in. in section; the charging arrangement being that known as the truck system. No hasty action in the erection was permitted; everything being studiously avoided which it was thought would prevent its proper working. There was no doubt about the internal arrangements of the setting; but they were looked to as being the most vital and important part of the plan—the system of heating being regenerative, and a speciality of the writer's own. The heating arrangements were most successful. The retorts at all times of opening had no sign of tar on the mouthpieces; the heats were uniform from end to end, and each alike. The charges were also even, although this part of the erection had to be carefully watched, and many little things altered, both in shoots and several minor parts of other portions of the apparatus. In the end, the experience gained was sufficient to warrant the further extension of the system.

A few figures in connection with the working of this

setting may be of interest and value. The coal carbonized per diem was 7 tons; the fuel used being 9·74 lbs. of coke per 100 lbs. of coal carbonized. The make per ton during two days' trial averaged 10,870 cubic feet; and the illuminating power of the gas was 17½ candles. The mixture of coal used was for the greater part Staffordshire, with some little Derbyshire, and 5 per cent. of common cannel. There was no difficulty in charging, after a few days' experience. All the various classes of coals used could be treated in a very successful manner; the charges oftentimes being 6½ cwt. per retort. The latter were purposely worked out of shape, in order to test the flow of material. The layers were evenly placed, and followed the shape of the retort; and although a little more attention was required in the drawing, as the coke would not fall out freely, in all other respects the conditions remained as with retorts in good form. From this experimental working, it was found that the angle of repose might with safety be increased; and consequently, in making plans for extending the system, the retorts were set as follows: The bottom retorts at 30°, the middle ones at 30½°, and the top ones at 31°, as against those of the trial setting—28°, 29°, and 30° respectively.

It will be well now to give a general outline of the erection, which many of the members of the Institution have inspected, and which has been commented and reported upon from to time in various publications. The plans as exhibited will explain the position occupied by the installation. The retort-house is 72 ft. 6 in. wide, 129 feet long inside the walls, and 33 ft. 6 in. high to the bearing of the principals; and the coal-sheds adjoin the house. When filled with the proposed number of retorts, this house will be capable of dealing with 200 tons of coal per diem, working six-hour charges, equal to a make of upwards of 2 million cubic feet of gas; and the writer ventures to say there is no retort-house erected at present, and filled with retorts on the horizontal system, capable of turning out a like quantity of gas per foot of space occupied as by this arrangement. This is point No. 1 in favour of the system.

The retort-benches will be in sections of four, consisting of six arches 7 ft. 6 in. wide, placed on either side of the chimneys; each arch holding six retorts 15 feet long, and 26 in. by 15 in. in section (D shape), or a total of 144 retorts. The charging-floors are on the sides of the retort-house walls; and the drawing space in the middle of the house has 20 feet clearance between each bench. The subway is below this space, where the operations of clinkering and attending to fires are performed, and where it is intended, as soon as practicable, to fix conveyors for the removal of the coke discharged from the retorts. Elevating machinery is fixed in the coal-stores; coal is discharged into push-plate conveyors fixed in the roof and carried into overhead tanks, of which there are two, capable of holding 40 tons each, and from which coal is discharged into a waggon holding sufficient for six charges—namely, 45 cwt. Shoots are used, and travel along rails fixed to an upper staging running the whole length of the retort-bench. The elevating machinery is in duplicate; and each is powerful enough to treat 20 tons of coal per hour, or sufficient for the combined requirements of the full house when complete. The retorts are set on the regenerative principle, and heat remarkably evenly and well; while any degree of heat can be obtained with little difficulty. The charges are placed uniformly even, and are well worked off; no tar is visible upon opening the retort-lids; and the coke runs out freely and without trouble. The second six settings have worked far better than the first, owing to slight increases in the angles of repose of about half a degree each; and, from experience, the writer would strongly recommend that no retort should be set at a less angle than 31° for the lower retort, 32° for the middle retort, and a little more than 32°—say 32½°—for the top retort. At these angles the flow of coal can be readily adjusted; and the coke will flow without trouble and practically no labour.

Here, also, figures of cost will be interesting; and the writer wishes it to be understood that the whole of the work (with the exception of the external walls of the retort-house and roof, together with alteration of sheds) was carried out by the men employed on the works, and that some portion of the castings—such as hydraulic mains, bridge, and dip pipes—used were not new. The retort-house and roof, together with the alteration of coal-sheds (viz., raising walls from 12 feet to 20 feet) cost £2700. The bench, containing twelve arches filled in with 72 retorts, 15 feet long, with all fittings, foundations, and chimney, 73 feet high, together with a subway the full length of the house, and large enough for the second erection, cost £5076. The charging-floor and upper stage, with shoots and waggons, cost £661. The elevating machinery, with two engines, boilers, &c., and conveyors, cost £1378.

On analyzing these charges, and taking that for the bench—viz., £5076, which includes foundations, subway, regenerators, chimney, bench, and fittings, all complete—they will be found to work out to an expenditure of £70 16s. 8d. per retort. Again, taking the cost of the charging-floors and upper stage, including shoots and waggons—viz., £661—shows an expenditure of £9 3s. 8d. per retort. Taking the cost of the elevating machinery, and store-tanks, &c., at £1378, shows an expenditure per retort of £9 11s. 5d. As this part of the plant is powerful enough to treat the total supply of coal required for the whole installation when complete, the amount of cost has been divided by the number of retorts to be erected. The total cost, therefere, will stand at £89 11s. 9d. per retort.

If the figures of £70 16s. 8d. per retort—excluding the machinery and charging-stage—are taken, and multiplied by 6 (the number of retorts in each arch), a figure of £425 is obtained, which represents the amount paid per setting for a carbonizing power of 9 tons of coal per day, or £47 4s. 5d. per ton per diem, which is a low figure in comparison with that paid for (say) arches containing eight through retorts, 20 feet long, and 22 in. by 16 in. section, fitted on the most modern principles, and on the regenerative system.

The figure of £44 may be safely taken as being the cost of such an arrangement per mouthpiece, which, for an arch containing 16 mouthpieces, will amount to £704. A setting of this kind, working six hours, with 3½ cwt. per mouthpiece, will equal a power of 11 tons 4 cwt. per diem, or, in cost of erection, the figure of £62 13s. 9d. per ton of coal power per diem.

The elevating machinery is designed to do its work in about five hours per day, or sufficient for the present twelve arches, and ten hours when the whole is complete. It will be seen that the wear and tear under these conditions cannot be heavy; and the writer takes it there is economy in erecting machinery of this kind much in excess of requirements, besides obviating the necessity of night working of this part of the plant. With regard to repairs, any ordinary handy man can do what is found to be needed. The charging part of the apparatus is simplicity itself. There are no delicate parts to get out of order; and so far it may be said that the cost of repairs to this portion of the apparatus has been but a few shillings.

To sum up in a few words, there is a saving all round, for there are no shovels, rakes, coal-barrows, scoops, &c., to wear out; and the repairs to machinery of all kinds will not cost per annum as much as the tools used in the ordinary forms of stoking, and the writer would say not nearly so much as drawing and charging machinery.

As the result of working this installation, the author has learnt that the work can be performed with ease and comfort to the workman, for his labour is not so arduous; and he leaves it showing no signs of fatigue—in fact, he expresses the reverse of this. The attention to fires is simple; and the fuel used is very small in quantity—being less than 10 per cent. The drawing and charging can be performed in a very short space of time. Five men will readily draw and charge twelve retorts, attend to fires, and trim coke in the yard in 30 minutes (several gangs, indeed, will do this work in 20 minutes); the weight of coal thus treated being about 4½ tons. (Recently this weight has been reduced for certain fixed reasons, which, it may be said, are experimental.) Wear and tear of machinery is found to be very slight; and this, it is understood, is the case in many other works. The class of men who make good shovel chargers and stokers becomes more difficult to obtain year by year; hence it will be seen how readily this system lends itself to the employment of a class of labour hitherto not capable of undertaking stoking as performed on the old lines.

The experience gained leads to the following conclusions: The make per ton is maintained on this system as on the horizontal one, if charges are even, with uniform,

regular, and constant heats; and the writer cannot see why this should not be so, nor from the very first would he admit any of the assigned reasons for an opposite conclusion. The make of gas per ton, when working with this system alone, has been 10,240 cubic feet. The gas was put into a separate holder, so that the candle power might be ascertained; and the result showed a make of 16·40 candles, without the use of cannel—the coal used being a mixture of Midland, with one-third Staffordshire. There has been no difficulty in increasing the make to 10,800 or 11,000 cubic feet per ton; but, for various reasons, it is kept down to an average of about 10,200 cubic feet for the twelve months.

Experimenting with the first section of six arches, as visited in October of last year by the members of this Institution, the writer especially arranged the long length of rising pipes with a view to preventing stoppages, owing to the increased size of the retort, and consequently greater charges and volume of gas to be given off; thinking the long length would cause a small amount of condensation and moisture, and thus obviate stoppages should there be any tendency that way. This was a partial error, as it was found that the length of pipe caused the gas to be wiredrawn, and during the evolving of a greater volume of gas gave rise to pressure upon the retort; and stopped pipes were often met with. The second six settings were fitted up with shorter rising pipes, the length of travel was reduced by about 8 feet, and, as a consequence, perfect comfort ensued. Gas passes away freely, and very rarely is a pipe found stopped.

Now with regard to tar. Why there should be a doubt in the mind of any engineer on this head, the writer cannot conceive. He presumes the idea prevailing is that, because the retort is inclined, tar must run away to the lower end, and thus be lost; and very possibly this idea has gained ground from the fact of so many installations producing such quantities of tar on the mouthpieces. This is not the case at Coventry, nor would it be elsewhere if erections had been conducted on proper lines. If the coke made in retorts set horizontally is examined, a pitchy appearance will be found in that portion lying in contact with the retort; while, on the other hand, coke taken from inclined retorts will not present any such appearance. In the author's opinion, this points to the fact that, during carbonization, some tar falls to the under side of the coke, and is caked, in horizontal settings, while in inclined retorts the tar flows towards the mouthpiece; and this gives rise to the erroneous belief mentioned. During the past year, about one-third of the coal has been carbonized in the inclined retorts; and the tar shows a make of 11 gallons per ton of coal used.

No reference has been made to the saving effected by the use of this automatic arrangement as against ordinary stoking. It may be taken as a fact that the total carbonization wages will not exceed 1s. 6d. per ton; and this includes all charges from the time the coal is stacked in the sheds to the trimming of the coke in the yard. The outside figure is here given; but this must be a varying one according to circumstances.

The author would say, in conclusion, that it will afford him great pleasure to make more clear the meaning of any points which may not have been quite plainly expressed in the foregoing paper; and he desires further to add that he has no interest, other than the simple one of progression, in the introduction of this automatic system.

IMPROVED SYSTEM OF WORKING INCLINED RETORTS.

By J. F. Braidwood.

In 1890 it was decided to erect eight settings of inclined retorts at the Greenwich works of the South Metropolitan Gas Company; and an existing retort-house was utilized for this purpose—some old arches having been pulled down to make room for the installation. Four of these settings were to be of the Coze pattern, 10 feet long, with seven ⌂-shaped retorts in each bench, and the other four were to be ordinary ⌂-shaped retorts 15 feet long. It appeared to the author that, if material saving in labour was to be effected, it must be by placing a larger quantity of coal in the retorts, and that, to do this effectually, it was necessary to determine the inclination best suited for the purpose; the angle of 29½°, as adopted in the Coze design, being considered insufficient. To ascertain the most suitable angle, repeated experiments were made with one of the 15-feet retorts; and finally 36° was decided upon. In order to place coal fairly in retorts set at this angle, the author was led to design his pneumatic charging-machine, by means of which a steady flow of coal is continuously maintained.

The angle of 36° having been determined upon, the main arches were built accordingly—a 14-inch ring being turned from the side walls to form a face for the work, and a starting-point for the sloping main arch; and although it was anticipated that there would be considerable difficulty in building a row of arches at this inclination, this was not experienced. It was decided to place seven retorts in one arch, which was 9 ft. 6 in. from wall to wall. The 15-feet retorts were supported by six 9-inch intermediate walls; the back and front outside walls being 14 inches.

The furnace used was of the ordinary generator type; and almost exactly the same as that which had been successfully used at the East Greenwich works for heating settings of ten retorts. It consists of a chamber 4 ft. 6 in. long, and 2 ft. 2 in. wide, and 6 feet high, with four pieces of angle-iron which form the fire-bars, and are placed at an inclination, in order to let a small stream of water run down each. The arch of the furnace is semicircular, and one brick thick, and has equally distributed in the centre nine nostril holes, 3½ inches by 2 inches. At the sides of the furnace are placed secondary air-flues, so arranged that the air is carried backwards and forwards three times; the object being to heat it somewhat before it enters the combustion chamber. From the top part of these secondary air-flues are led, close down to the furnace arch, nine outlets, so that the air is brought from either side to meet the gases issuing from the nostrils of the furnace. Combustion then takes place; the heated products travelling throughout the setting, and ultimately discharging into the main flue, which runs along the back of the setting, just under the bottom retort.

Although these settings did fairly good work (having been almost continuously in action for the past two years), the author did not consider them so satisfactory as he could wish; but the experience gained showed that, by making considerable alterations, very much greater economy in working, and more uniform heating, could be obtained. It was therefore decided to put up a further number of 14 settings of six retorts each; the main difference in these being, that the centre retort was done away with, and the size and shape of the furnace altered as follows: It was made 3 feet wide and 4 ft. 6 in. long—the furnace arch being put in at two levels from end to end of the setting; while the setting was divided into two parts above the arch. Two sets of secondary air-flues were arranged on either side of the furnace, to supply the back and front part of the setting, independently of each other, with secondary air; while the gases from the furnace were common to, and supplied, both arches. Each setting is also provided with four dampers, exclusive of the main dampers, so that the heat may be increased as desired at either the front or the back of the setting. Suitable mouthpieces have been bolted on at either end of the retorts. The top or charging mouthpiece is 20 in. by 15 in., nearly oval in shape; and the bottom or discharging mouthpiece, to which the ascension-pipe is attached, is 26 in. by 19½ in., and, like the retort, in shape a combination of an oval with a ⌂. The retorts taper 2 inches in the length of 15 feet; being 24 inches wide just inside the 14-inch work at the top, and 26 inches wide at the bottom. By this arrangement, although the angle has been reduced 2°, the drawing or discharging is very satisfactory indeed.

Seven of these settings are now at work, and another seven are in course of erection. The charging-machines, shoots, coal-hopper, hoists, &c., in use with them are precisely of the same design as those used for the first section; the author having, up to the present, been unable to find any more convenient or suitable method.

The coal carbonized in these retorts is brought direct from the ships in trucks; and, by means of a hydraulic chain hoist, these are lifted on to rails at the top of a high-level hopper, where the coal can be distributed at any portion by a man lifted with the trucks. At the bottom of this hopper are placed, at frequent intervals, small slides or doors, from which the coal is run into the chargers, which in their turn convey it to the top portion of the retorts. Thence, by means of a light sheet-iron shoot running on wheels at the back of the setting, the coal is

directed from the charging-machine to the mouthpiece of the retort.

A brief description of the pneumatic chargers as designed by the author for working the retorts, is as follows: * On a strong, light, wrought-iron framework, mounted on four wheels, are placed two tilting-tanks, carried on trunnions; and attached to the frame in front of each box is a shield or guide-plate for the coal. In working this, the bottom end of a portable shoot is first put into the mouthpiece to be charged. The charger is then brought opposite; and the shield, being lowered on to the top of the shoot, forms a guide for the exact position of the charger, as also a guard to prevent any waste of coal. The attendant then pulls a rod at the back of the charger, which opens a door at the lower part of the front end; and at the same time, by means of a tappet on a rod, releases a catch, which allows the box to tilt slowly forward—the speed of tilting being regulated by an air cylinder placed in the framing of the charger, the piston-rod of which is attached to the bottom of the tank. This piston regulates the speed of tilting as may be required; the result being that a steady flow of coal enters the shoot. The tank, when emptied, is drawn back to its place by the attendant, when, the rod being released, it at once shuts the door, and fastens the tank in position. The shield being then lifted, the truck is moved on to the next retort.

Before comparing the cost of working the inclined retorts with the most economical handwork on the old plan at Greenwich (which consists of settings of seven 21 in. by 15 in. oval retorts, 22 feet long), it may be of interest to state the relative cost of erecting the two systems. The expenditure for horizontal retorts, including main arches, stage, chimney, setting, &c., amounted to £44 10s. per 11-feet retort; while the cost of the new inclined retorts, including overhead hopper, hydraulic lift, &c., works out to £97 per 15-feet retort—all labour and materials being included in both cases.

The cost of labour for working the two systems is as follows: The wages of a gang working one side of horizontal retorts amounts to £3 12s. 6d. for 24 hours, during which time 27 tons 12 cwt. of coal is carbonized; this being equal to 31·63d. per ton, which includes all retort-house labour. For working the new inclined retorts, a gang attends to seven settings; and the wages paid for all retort-house labour for carbonizing 38 tons amounts to £2 8s. 6d., or 15·3d. per ton. This shows a difference of 16·33d. per ton in favour of the latter.

Taking 56,527 tons, the total quantity of coals carbonized at Greenwich for twelve months, this would, at 31·63d. per ton (old system of hand work), amount to £7449 15s. 9d.; but if the same amount had been carbonized by the inclined retorts, it would have cost only £3603 11s. 11d. The saving effected in the carbonizing wages alone would thus be £3846 3s. 10d. As, however, these wages represent only the men who are actually employed in handling the coal and coke, there would be 5¼d. per ton to be added to both, for pipe-jumpers, flue-cleaners, scurfers, lobby-men, engine-drivers, boiler-firemen, and foremen, which are included under the heading of "carbonizing wages." The total would therefore be: For hand work, £8686 6s. 3d., or 36·88d. per ton; for inclined retorts, £4840 2s. 5d., or 20·55d. per ton.

Although the author has at present two-thirds of the total number of retorts at work on the inclined system, he has never worked them exclusively."

The figures given above show the saving in the wages alone; but there is no doubt whatever that very great economy will be effected by the increased life of the settings, which will probably be double that of the old work before referred to. The author is also of opinion that, where a proper system of inclined retorts is adopted, there must be a very considerable benefit conferred, both on the workmen employed and on the employer—so much heavy labour being entirely dispensed with.

THE APPLICATION OF MACHINERY FOR WORKING HORIZONTAL RETORTS.

By C. C. Carpenter.

The problems which the evolution of chemical industry is creating present themselves for consideration from two standpoints—the mechanical and the chemical. This is not less true of one for which it may be fairly claimed that it is not the least important of these manufactures, though it is frequently regarded merely as an offshoot of engineering practice similar to that of water supply—namely, the carbonizing of coal for the manufacture of illuminating gas. Consideration of the *rationale* of carbonizing, like that of other kindred processes, becomes to a great extent an investigation into the best condition for the handling and treatment of the raw material.

It is a significant fact that the former branch of the subject has, judging from what has been said and written upon it, received by far the larger share of the consideration given to carbonizing as a whole; the bulk of the efforts towards its improvement premising hardly any other conditions than the facilitation of the operation of putting coal into a retort, and after a given period drawing out the non-volatile residue of coke. Yet nearly twenty years ago one inventor, whose work has since achieved a large measure of success, directed his efforts to reach the goal of complete and therefore dual efficiency. By first breaking the coal to a uniform size, then raising it by a power elevator of the simplest description to a hopper, whence the force of gravity was so utilized as to permit its being charged into the retort with scarcely any further expenditure of energy, by spreading the charge in a thin even layer which was burnt off in four instead of the customary six hours, Mr. West set up a carbonizing standard which is to-day still of the greatest value in connection with this all-important question. In such an operation as has just been described, the only manual labour necessary is that required to push in and withdraw on a level plane a light charging trolly mounted upon wheels and carrying the coal.

Now, if the conversion of coal were a process of distillation instead of carbonization, or, in other words, if instead of leaving behind the bulk of its original weight in the form of coke it wholly vanished up the ascension-pipe, the solution of the problem entered upon in 1873 would now most probably have been settled upon something like the lines stated. But the drawing of the spent charge cannot be considered as even the lightest part of the operation; and although the framing of the manual machine then introduced was of some slight service in supporting the weight of the rake-rod, yet practically it may be said that no help was afforded the stoker in this, the most arduous part of his work. To design a power machine was therefore the next and natural step forward.

Before, however, leaving for the present the consideration of the manual machine, one other important point in its favour deserves mention. To charge with a scoop a through retort requires a double gang consisting of at least six men. Its use is, therefore, out of the question in most of the smaller-sized works; and recourse must be had to the less suitable method of shovel charging. With the manual machine, however, two men can perform with ease what it will take six men to do with scoops. The importance of this in the above-named cases cannot be easily overstated.

Meantime, other inventors were not idle while the manual machine was being worked out. Among other appliances brought out about this time may be mentioned those of Rowland, Somerville, and Foulis. Their examination is of interest, as affording evidence of how largely the problem of carbonizing was being contemporaneously attacked from the point of designing a machine to put coal into, and draw coke out of, a retort, as distinct from its proper carbonizing and its economic handling from the stores. It should be stated, however, that the Foulis machine was primarily constructed for dealing with cannel coal, in which case irregularities in charging would probably be of small consequence.

Though in one sense foreign to the scheme of this paper, it may, perhaps, not be out of place to ask whether the feasibility of using vertical retorts for carbonizing cannel for gas-making purposes has been considered by those engineers depending upon this class of coal. Doubtless many members of this Institution visited, as did the author, in 1887, the works of the Broxburn Oil Company, where about 1000 tons of shale were being operated upon daily in the Henderson vertical oval retort. For gas engineers, the question is perhaps one of theoretical interest only, as the use of cannel for gas making appears to be rapidly diminishing.

* Mr. Braidwood's machinery was described and illustrated in the JOURNAL, Vol. LVIII., p. 579, and Vol. LIX., p. 1119.

There has now to be considered the question of power machines for stoking, as these are available to-day. The list is but a small one, and practically is comprised by the Foulis-Arrol, the Woodward, the Ruscoe, the West, and perhaps the Ross types.*

As regards the drawer, the author proposes to put aside any particular reference to this part of the plant, because there is a very strong family likeness between most of these machines, and because the conditions of likeness, efficiency, and adaptability readily lend themselves to their designing. With the charger, the attainment of these conditions is a far more serious matter. Taking the last of the above list of machines first, the Ross steam-stoker affords an excellent object-lesson of how widely separate what may be called mechanical and chemical efficiencies may become. As is generally known, this machine consists essentially of a coal-hopper terminating in a shoot, at the rear of which is fixed a horizontal pipe perforated with holes. To charge a retort, the hopper shoot is inserted in the mouthpiece, while steam, admitted to the perforated pipe in two or three sharp blasts, blows in the coal in a more or less uneven layer. With practice on the part of the attendant, it was possible to attain some sort of a degree of regularity in doing this; but the process was at best very uncertain. It has been stated by the President that the make of gas was reduced by several hundred feet per ton when working these machines at the Nine Elms works. This can easily be believed. It is one thing to put coal into a retort; it is another to so place it therein that it is carbonized under the best conditions. Though it may be claimed for the Ross stoker that it performs the first operation with admirable simplicity, it undoubtedly quite fails with regard to the second.

In the next machine to be discussed—the West—the action of the scoop in charging by hand is more or less reproduced. The scoop, which is the full length of the retort, enters twice; emptying itself alternately left and right. It is constructed with a thin blade running down its centre; the special object of this being to throw over and distribute the coal evenly on the bed of the retort when the scoop is turned. It holds 2 cwt. of coal; so that the charge is 4 cwt. per mouthpiece, or 8 cwt. per retort. In the author's opinion, this heavy charge is a mistake, notwithstanding that the retorts may be easily arranged to burn it off; and that it is in this respect a decided step backwards from the earlier practice of the inventor, to which attention has already been directed. It must be understood, however, that it is not the general design of the machine which this expression of belief calls into question—on the contrary, this has his cordial approval, containing, as it does, many features of excellence—but rather the arrangement of it for dealing with such a heavy charge as has been stated. The carrier to which the scoop is attached runs in horizontal guides on the framing of the machine. Each extremity of this carrier has a chain affixed thereto, which passes for several turns round a drum. By means of a rack and pinion, this drum is rotated in either direction as required, and the carriage with the scoop is thus drawn into or out of the retort. The arrangement is working well in various parts of the country; the installations presenting the latest features being that at the Old Kent Road works of the South Metropolitan Gas Company.

In the Ruscoe machine, like the last, the coal is charged by means of a scoop. There are, however, two of these arranged close together, and side by side. To the heel-piece of each a spur-wheel is attached; and the two gear together, so that the scoops turn in opposite ways when a rotary motion is applied to one of them. This operation is performed in alternate directions by an ingenious, though simple, mechanism when the scoops are fully in or out of the retort as the case may be. Each holds $1\frac{1}{2}$ cwt. of coal, so that the normal charge of 3 cwt. is placed in the retort at one operation; while the design permits the scoops to be made simple and light—thus accommodating themselves to any irregularities of the retort, without throwing undue strain on any part of the machine. They are attached to a carrier, which is moved to and from the retort, by chains running over drums, in much the same manner as in the West machine. The coal is distilled in a very thin layer; and experience of the working of these machines at the Bromley works of The Gaslight and Coke Company will be watched with great interest.

Very similar as regards the charging arrangements is the Woodward machine, in which also two scoops are used. Their two adjacent sides are of greater depth than the opposite ones; the extra portion acting as a blade which distributes the coal well over towards the sides of the retort. The simultaneous rotation of the scoops is effected by means of a crossed chain, running over a drum attached to the heel of each, instead of by the spur-wheels in the Ruscoe arrangement. With all the last-mentioned machines, the placing of an even layer of coal presents no difficulty of accomplishment.

In the Foulis-Arrol machines, the inventors have struck out a new line for themselves. The charger consists of a pusher-head, by which the charge in measured portions is thrust along the bed to its place in the retort; the stroke automatically diminishing until it is charged. A hopper is fixed at one end of the machine, having an opening by which its contents can be discharged between the pusher-head and the mouthpiece on to a short shoot placed therein, and from which it is propelled into the retort as described. The coal-feed is regulated by means of a drum, which is divided up radially by blades into as many compartments as there are portions into which it has been determined to split up the charge. This drum is revolved in conjunction with each stroke made by the machine; and thus delivers coal on to the shoot in quantities which may be increased or reduced as required. The shortening of the pusher stroke is also effected automatically by means of a shaft running parallel with it, and on which is placed a series of stops, which rise through openings in the guide-bar, and thus stop further motion of the carrier until it is reversed. This carrier has attached to each end a steel-wire rope, passing round the sheave of horizontal hydraulic rams placed alongside the guides, and which, when pressure water is admitted by a three-way cock, draw it either into or out of the retort. The retort is charged in from six to eight strokes of the machine. A large vertical cylinder and ram is provided to raise and lower the charging-frame to suit the various levels of the retorts.

As regards the carbonizing efficiency of the machine, it is a little difficult to speak. It would certainly appear at first sight that a machine which in charging does so in six or seven operations, though these are very rapidly performed, has not on this score so much to recommend it as another in which this is done at one operation; and the author is not of opinion that any reduction thereby obtained in the weight of the machine is altogether a counterbalancing justification. This, however, may indeed turn out an advantage, since by a modification of charging, to which the machine readily lends itself, each portion of the charge of coal could be so placed in the retort as to leave a space between it and the next; thus giving a larger surface for carbonizing, permitting easier egress of gas, and to an extent facilitating the operation of drawing. It seems probable, too, that some difficulty might arise as regards the placing of the charge in an even layer, dependent for extent upon the size of the coal and the shape of the retort. An oval retort is easier to draw than a ⏢, and a circular than an oval. This fact is of importance in studying the action of the pusher, which is, after all, but a rake worked, as it were, backwards.

To illustrate what is meant, the coal may be assumed as having the form of ordinary briquettes, four (say) of which are placed side by side on the mouthpiece, and pushed into the retort. Under these circumstances, whether the retort was of circular, oval, or ⏢ shape, the "charge" would, of course, be in an equal layer. Suppose, however, fine coal were substituted for the briquettes; in thrusting this into the retort its upper surface would, during the process, become level, while the remainder of its section would be that of the interior of the retort. With cannel this would, of course, be immaterial; but with caking coal it would not give such a disposition of the charge as would be conducive to obtaining the best results. The author, in noting these points, does not, however, look upon their improvement as presenting insuperable difficulties.

Attention will now be given to the best mode employed for actuating power stoking-machines. For this purpose, steam, fast-running cotton or wire ropes, coal gas, hydraulic pressure, and compressed air are all available, and have been applied with varying success. The use of steam has not been very successful, since, for practical

* The Foulis-Arrol machine was described and illustrated in the JOURNAL for Sept. 27 last (p. 555); and descriptions of the others have appeared therein from time to time

reasons, this entails the attachment of a boiler to each machine. Boiler repairs, therefore, throw a machine wholly out of action. The large increase of weight entailed is another great objection; while a retort-house cannot be considered as altogether the best place for such an appliance, which can, indeed, be more economically looked after, and more profitably worked, when placed away from the scene of action in a properly constructed house.

As regards cotton or wire ropes, though these have their able advocates, the author cannot look upon their adoption as desirable. In order to transmit the required horse power, it is necessary to run them at a very high speed, while a considerable amount of fast-running gearing and belting is necessary to convert their motion into that required by the machines. The objection is only a valid one in the retort-house, which is ever charged (or at least while the machines are working) with a heavily-laden atmosphere of coal and coke dust. The idea was probably obtained from the travelling cranes used by Mr. Webb in the Crewe Locomotive and Carriage Works, where, needless to say, the conditions are quite different.

Messrs. Woodward and Crossley have just introduced a novelty into their stoking-machines by the attachment to each of a gas-engine, supplied with gas from a bent tube running in a water-sealed trough extending the whole length of the retort-house. It is rather difficult to see in what way this is a better arrangement than using a flexible rubber pipe. Apart from this, however, while the author holds strongly the opinion that more should be done by engineers in the direction of adopting gas-engines in their works, he cannot consider a stoking-machine as the proper place for them. The strains set up in working them would not be a good thing for the framing; and as a gas-engine is certainly of more delicate mechanism than a steam-engine, it would be better to use, instead of a minimum of four small ones, one large one, and that too for compressing air or pumping water instead of rope driving.

Between these two motive forces, there is not much to choose; both have been used to a considerable extent. If for no other reason than the great difference in their specific gravities, it should be more economical to distribute compressed air rather than water. The latter, at a pressure of 750 lbs. per square inch, is used on the author's works for various purposes, one of which is the lifting and traversing of the purifier-covers—using lengths of flexible canvas and rubber hose to form the connection between the traveller and the main. In many motors, however, water pressure cannot be employed economically, since the fluid is practically incompressible. Air, on the contrary, can, under pressure, be used expansively, and considerable economy be thus obtained. Whether hydraulic pumping or air-compressive engines be used, these should certainly be the most economical of their type.

Both Mr. George Livesey and Mr. Corbet Woodall have in the past paid a considerable amount of attention to, and advocated with great earnestness, the use of economical steam-engines for exhausting gas. The author has daily evidence of the wisdom of their foresight; and he would urge that what holds good for exhausting gas applies with equal force to its production. An uneconomical engine means but the transference of capital expenditure from the engine to the boiler; while labour and fuel charges become an everlasting drain. Professor Goodman has made some interesting trials of a two-stage condensing air-compressing engine lately introduced, which possesses several features of interest, though it is not possible to include their description within the limits of this paper.

The last aspect of power-stoking to be considered is the supply of coal to the machines—a problem frequently difficult of solution in retort-houses not specially constructed for the admission of machinery. At the Salford Corporation Gas-Works, a very ingenious scheme was worked out for this purpose. This consists of a conveyor running above the charger the whole length of the retort-house. What may be called the buckets of the conveyor are unusually long—nearly as long as the charging-hopper. They are so arranged that a stop fixed on the machine causes them to turn over as they pass above it, thus tipping their contents into the hopper. A more generally adopted plan, however, is to place above the path of the charger a fixed hopper, holding about 10 tons, and fed by an elevator from a breaker placed conveniently in the adjoining coal-store. The machine is run under these hoppers for replenishment as required.

In considering, three or four years ago, the adoption of machinery in a retort-house to which no coal-store was adjacent, and where it was imperative not to lose that afforded by the stage, the author suggested the attachment to the charger of an elevator so arranged as to lift coal continuously, whether stationary or traversing—in the latter case, to clear itself by a plough attached on either side. The arrangement has since been patented.

Quite recently, Messrs. Foulis and Arrol have brought out another method for overcoming similar difficulties. To the framing of the machine an hydraulic radial crane is so attached as to lift coal from the store behind by means of skips, which open from the bottom, and discharge their contents into the machine hopper. Should this arrangement, which has been erected on the large scale, prove successful, a frequently-recurring difficulty will have been overcome in a very original manner.

From what has been stated in the forgoing paper, it will be seen that, taking as they stand the structural conditions of most retort-houses, the problem of drawing retorts by power is of far greater simplicity than that of charging them. It has, indeed, been proposed to take advantage of this almost universal adaptability possessed by the power drawing-machine, to use it in conjunction with charging by hand with scoop or shovel.

The author considers, however, that such advantages would be nearly, if not quite, counterbalanced by the necessity for handling the coals once or twice before they are filled into the retort, since the charging-floor must be kept quite clear for the passage of the machine. His own belief is that, in many cases, nearly all the advantages of power stoking may be obtained by the use, in conjunction with a power drawer actuated by air or water pressure, of the West manual machine, with fixed hoppers, coal-breakers, and elevators. In such a case, the only manual labour will be that required to push and withdraw the charging-trolley; and the cost of carbonizing would not much exceed 1s. 6d. per ton.

Store-hoppers, coal-breakers, and elevators are necessary adjuncts of any of the systems for economic carbonizing (excepting that of Messrs. Foulis and Arrol) which have been proposed; so that the only additional charge would be for the drawers, manual chargers, and plant for producing the motive force. Retort-benches and the retort-house would remain exactly what they now are; and in most cases the existing floors would be amply strong enough to carry the light machines described.

In conclusion, the author trusts that the importance to gas engineers of efficient, as well as economical, carbonization will be considered sufficient justification for bringing the subject before the members of the Institution.

Discussion on Mr. George Livesey's Paper on Differential Prices for Gas.

The President, in inviting discussion, suggested that those who were intimately connected with the policy of gas undertakings were the right men to speak upon the subject before the meeting.

Mr. R. O. Paterson (Cheltenham) considered the subject brought forward by Mr. Livesey was certainly one which deserved and required very careful consideration. In the main, he agreed with the views of the author of the paper. He could not understand the possibility of arriving at a just conclusion in those enormous allowances made in some manufacturing towns in the form of discount from the usual selling price. He rather thought the policy should lie in the equalization of prices as far as possible over the whole area of supply. In his own case, they had two prices scheduled in their Act of Parliament—one for the parish of Cheltenham, and the other for the out-parishes; but some years ago the Directors, finding a certain amount of difficulty in satisfying the consumers on the boundary-line of those parishes, considered the matter, and decided ultimately to abolish the differential rates, and make one uniform charge over the whole area of supply. This system had been in operation now for some years, and had worked very satisfactorily. Another peculiarity he might mention was this: They had a statutory discount of 5 per cent., which must be allowed on all accounts paid at the central office of the Company within fourteen days. They went no farther, except in the case of the public supply.

Mr. T. Newbigging (Manchester) said it was always a

pleasure to hear Mr. Livesey on any subject. They expected from him both logical and exhaustive treatment of any question he took up; and he (Mr. Newbigging) agreed with him to a large extent in the views he now expressed. He thought that large consumers of gas, like wholesale purchasers of any other commodity, were entitled to have their gas at a slightly lower price than the smaller consumers. This was only fair; and it was the principle adopted in general business. Mr. Livesey had not touched on the question of differential rates in districts outside boroughs where the gas-works belonged to a local authority; and he should like to hear his opinion on that point. Mr. Paterson evidently thought it was desirable there should be a uniform price; and no doubt it was very convenient for gas managers, and perhaps saved friction, with less liability to mistakes in bookkeeping. At the same time, he did not think it was quite meting out the justice between consumers on which Mr. Livesey laid so much emphasis. This was particularly the case when the gas-works belonged to a local authority, and the consumers within the borough had contributed towards their establishment. They had to bear the risk of the large investment of capital; and surely they were entitled to some consideration on that account. Again, the suburbs of large towns were very often thinly populated; they covered a much wider area than the central portions, and the mains had to be longer, and also larger in diameter, and the leakage was consequently greater. For this reason also there ought to be a differential rate. Furthermore, he thought the poorer classes of people who lived in the vicinity of gas-works ought to have some consideration, because they had to bear the annoyance associated with the manufacture of the gas, whereas those outside were far removed from any danger of nuisance in this respect. It was a very happy suggestion that there might be a differential rate for varying qualities of gas. He had had the same idea himself; and he thought it might be easily adopted, and so a vast deal of friction and annoyance would be got rid of, especially in the Metropolis, where there were difficulties to contend with in this regard. There were not the same difficulties in the Provinces; but it must be very aggravating to Companies in London to be subjected to heavy fines for slight unavoidable defects in the quality and illuminating power of their gas.

Mr. A. Edwards (Taunton) said he had the good or the bad fortune to be guilty of giving the large special discounts which had been so strongly animadverted upon; but, in their case, he did not think they had anything to blame themselves for, inasmuch as it was forced upon them by the action of some large consumers in 1883. In 1877, they were selling to private consumers about 30 million cubic feet of gas at one uniform charge. In 1883, after a reduction in price of about 6d. per 1000 cubic feet, the consumption had grown to 40 millions; and they were then met with the question whether they would make a special reduction to large consumers, or whether their largest customer should make his own gas. Although they were strongly opposed at that time to the principle of allowing a special discount, they felt they could not lose that customer, as the plant had been provided to meet his requirements and those of other growing customers, and they were compelled to give in. At the end of six years —namely, in 1889—with a reduction of 3d. per 1000 cubic feet all round, their consumption had increased to 51 millions. Out of this rise of 11 millions, the increase of those who had special discounts was close on 7 millions, and of small customers about 4 millions; the result being that large consumers with special discounts had increased their consumption at the rate of 7·66 per cent. per annum, while the ordinary customers had only augmented theirs to the extent of 2·6 per cent. per annum. The Company's original practice was to allow a small cash discount of 3d. per 1000 cubic feet for payment within a month. This was afterwards varied by the addition of a scale up to 200,000 cubic feet. Up to 500,000 cubic feet per annum, it was 10 per cent.; from 500,000 to 1,000,000 cubic feet, it was 12½ per cent.; from 1,000,000 to 1,500,000 cubic feet, 15 per cent.; from 1,500,000 to 2,000,000 cubic feet, 17½ per cent.; above 2,000,000 cubic feet, 20 per cent.; and above 3,000,000 cubic feet, 25 per cent. They had no customer taking more than 20 per cent. These percentages were in substitution of the 3d. per 1000 feet. At the end of the first period, the sum received on the average less than the smallest customer would pay amounted to 1·09d. per 1000 cubic feet only; showing that no very great injustice had been done to the small consumer. The price at that time was 3s. 6d. for 17-candle gas; and the average amount received was 3s. 4·91d. Then he might take a further period of three years, in which the gas consumed went up another 3 or 4 millions; being 3·13 per cent. on large, and 2·8 per cent. on small customers. The fact was that, by means of these special discounts, they secured the custom of nearly all the large consumers it was possible to get in a small town. Of course, there was a limit to the application of this principle. The average for both periods was an increase of 6·15 per cent. per annum for large, and 2·66 per cent. per annum for small customers; giving 3·90 per cent. per annum for the average. This showed that they had increased more than they could have expected over the average by about 1½ per cent. At the end of the second period, they were receiving 1½d. per 1000 cubic feet less than the maximum price after the 3d. was taken off; and as Mr. Livesey, in his paper, had put down 1d. per 1000 cubic feet as what might fairly be allowed for the cost of collection and other items, the average sum received was not excessively low. Mr. Livesey, however, had omitted one very important point, and that was the incidence of capital and incidental charges. From the year 1877, they had increased the business from 29,700,000 to 54,500,000 cubic feet, and had not secured twenty additional customers. They had doubled the business with the same number of customers; and, although it was only a small provincial town, they were taking, on the average, about £8 per customer. He had left out the question of public lighting; but, including this, the average would be close upon £10. He ventured to say that, deducting the saving in charges on capital account (because they had not had capital expenditure of any moment to make), they were absolutely benefiting the small customer by the increased business they were able to obtain by means of the special discounts granted to the larger customers.

Mr. C. E. Botley (Hastings) asked if Mr. Edwards could point out the direction the increased consumption took—whether it was for heating purposes, or whether the whole was for lighting purposes.

Mr. Edwards said the bulk of the increase was for day use. During the winter, in the hours of daylight, they consumed, as it was produced, all the gas they were able to make per hour; and at this time of the year, they sold all the gas they made from eight o'clock in the morning till six in the evening. There were some special customers for factories; and he found that, when people could get an additional quantity of gas for a moderate payment over its cost, there was a general disposition to be liberal in the use of it; and they had to look to this for a large portion of the increase. He was bound to admit that they had also to look to special customers who used it for shirt-ironing. In this direction alone, they had increased the business, he should say, by 25 per cent., which would have gone to other towns with cheaper gas if they had not met their customers.

Mr. Botley said that in the year 1883, as the usual result of going to Parliament, and being placed under the sliding scale, their standard was revised, and two prices were then fixed—one for the borough, the other for the out-parishes; the difference being 4d. per 1000 cubic feet. He rather followed Mr. Paterson's idea with regard to equalizing the price of gas all round, because, although it was quite true that they did lay out a considerable amount of money by extended mains which were non-productive for the time being, there were the exigencies of public lighting, which compelled them to go there, and there were other considerations. As the members were aware, borough boundaries were most erratic. They went in and out; and it often happened, with two people living next door to each other, that one had to pay the full price while the other paid 4d. less per 1000 cubic feet. He therefore advised his Board that the loss which would accrue from equalizing the price would be more than compensated for by the simplicity, and the probability of increasing the consumption; and this had proved correct. Of course, the district had now developed, so that the reason for having two prices had ceased. With regard to the subject of discounts, which had been broached by many consumers, the Company had always sheltered themselves behind the sliding scale. They said that, if they reduced the price to large consumers, the reduction would

be affected by the sliding scale; and the shareholders would be entitled to more dividend. If the price of gas were reduced by 5 per cent., this would in their case be equal to 2d. per 1000 cubic feet; and if there were many in that position, it would bring down the average price paid, so that it ought to increase the amount of dividend. Whether or not this was optional, he did not know; but it appeared to his Board, and it had always been his idea, that they could not tamper with the price under these circumstances. He quite agreed, in principle, that large consumers should have the benefit of a discount, if only for the advantage of getting in the money promptly, and preventing bad debts. There was another point with regard to differential prices, which was perhaps hardly pertinent to the paper, but to which perhaps he might ask Mr. Livesey to reply. They had been thinking of introducing prepayment meters for small consumers, in order to popularize the use of gas; but in such a case, if they charged a different price, to include the rent of the meter, would this affect the operation of the sliding scale? He did not quite follow the author's suggestion with regard to reducing the charge according to the quality of the gas. Unless this was done within very narrow limits, it would not be possible, because the consumer, having 14-candle gas one day and 16-candle gas the next, would require constant attention to his fittings, in order to secure a satisfactory result, and so would be always complaining that he had a good light one day and a bad light another. It would not, of course, affect it so much for heating and cooking purposes.

Mr. C. Hunt (Birmingham) said there were exceptions to every rule; and perhaps Mr. Edwards's case was one. He went entirely with Mr. Livesey in deprecating the making of considerable allowances to large consumers of gas, or for its consumption for special purposes. One had to consider not only the quantity of gas consumed, but the incidences of its consumption. Take, for example, manufacturers using gas for lighting purposes only. The consumption they brought might be individually heavy; but it occurred during a very few hours, on only five days of the week, and throughout less than half the weeks of the year. If no other class of lighting existed to equalize matters, they could not be supplied so cheaply as the ordinary householder, with his comparatively modest quarterly account. Then with regard to favouring consumption in the daytime. This was a perfectly sound policy; but it could not be pursued to any extent with justice by reducing the price of the gas so consumed. A very ordinary figure for the interest or dividend charges of an undertaking was about 7d. per 1000 cubic feet, of which it might be assumed that one-third, or (say) 2½d., represented distributing plant. It was perfectly evident that the margin for reduction in such a case, to represent the advantage of more complete utilization of the mains, was an extremely small one. If he rightly understood Mr. Edwards, his experience seemed to show that an increased reduction of only 1½d. per 1000 cubic feet was sufficient inducement to prevent large consumers from manufacturing for themselves.

Mr. Edwards remarked that the reduction he referred to was from 10 to 15 per cent., which would amount to about 5d. per 1000 cubic feet, or about 7d. on the maximum price.

Mr. Hunt said if this were additional to the 3d. all-round reduction mentioned by Mr. Edwards, he must certainly have misunderstood him. There were one or two other points to which he would like to refer. Mr. Newbigging advocated differential prices for different districts. Mr. Botley had partly anticipated what he was about to say in reference to this—namely, that, in large boroughs especially, the boundaries were usually so straggling as generally to include consumption which was really suburban, and not distinguishable in this respect from that which occurred beyond the border line, and which might in reality be nearer to the gas-works. The simplicity—and he would venture to say the justice also—of an uniform rate was so manifest that he was quite sure those who once applied the principle would not seek to depart from it. As to the practice, which was not at all uncommon, of charging 1d. or 2d. per 1000 cubic feet extra for varying rates of consumption according to a graduated scale, he had in his mind an instance in which this differential charge paid the whole cost of collection and office expenses for the entire consumption—a system he could not conceive to be fair. The utmost that could be justified as an allowance to cover saving in collection and management appeared to him to be a small percentage, as advocated by Mr. Livesey, but probably not more than 2½ per cent. Having regard to the circumstances as a whole, he went the full length of advocating a uniform price throughout the entire district supplied by a gas undertaking, irrespective of the quantity of gas consumed, or the purpose for which it might be used, or the distance of the consumer from the works.

Mr. R. Morton (London) said he must take exception to a remark let fall by Mr. Newbigging. Speaking of differential rates and allowances, he specified one class of persons—namely, those living in the vicinity of gas-works—who, he thought, ought to be accorded some consideration in the way of allowance; but he (Mr. Morton) hoped his sentiments in this respect were not those of the meeting. He did not think they could be shared by those who managed their works properly; and it was a pity for such observations to be made in a meeting of gas men, as they might be taken up outside, and be made a great handle of elsewhere.

Mr. W. Foulis (Glasgow) thought the small consumer was very often the best all-the-year-round consumer. In Glasgow, there were a large number of these consumers—perhaps a larger percentage than in any other town. They had about 160,000 meters; but he believed their average rental was rather less than £2 10s. a year. They found that it was in the smaller houses, of (say) three or four rooms and a kitchen, that gas was most generally adopted for cooking purposes. He agreed that, as nearly as possible, a uniform rate should be charged, not only to every consumer, but over the whole district. They had had occasion lately to consider the question of making an extra charge for gas delivered to a district seven or eight miles distant from the works; and, after full consideration, the same price was charged as in other districts. He quite agreed with what Mr. Morton had said about gas-works not being a nuisance. If they were, it showed very bad management.

Mr. T. May (Richmond) said he agreed with what Mr. Livesey had stated with regard to differential prices; and, after the figures he had given, he did not think any case could be made out for allowing big discounts to large consumers. He believed in having a uniform price. He knew of a town where the consumers in houses with their gardens abutting on the gas-works wall paid 6d. per 1000 cubic feet more than others a mile away, simply because the works happened to be on the outside of the parish they were established to supply. This was a manifest injustice. Still it was a question whether they would be justified in lowering the price; the Legislature having decided that so much extra per 1000 cubic feet was a reasonable charge for districts where the bulk of the gas was being supplied at a greater cost for mains, services, collection, and so on, for it would re-act on the inner district, and have the effect of putting up the price there, although perhaps to only a small amount.

Mr. T. B. Ball (Rochdale) said the drift of the discussion appeared to be this—that no difference in price beyond 5 per cent. could with justice be allowed. Mr. Livesey started with a proposition that the concession to be made, if any, should not exceed 1d. per 1000 cubic feet. His own impression was that, if this was the whole concession which could be made, an all-round price was very much better. At the same time, he could not help thinking that a concession, even although they could not logically defend it, induced increases in consumption which could not otherwise have been secured. He was quite certain this had been so in his own case, where the charge for gas employed for cooking, heating, and motive power was lower than that used for lighting. The increase which had since taken place in the quantity of gas burnt for purposes other than lighting had been at least 50 per cent., compared with the normal rate of increase of about 2 per cent. in the lighting. Although one could not justify the concession on the logical grounds that so much was saved, those persons who were using this gas in mills, and for various industrial purposes, would not have burnt the gas, but would have employed other methods, if they had not had the gas at the cheap rate. He did not think Mr. Livesey had made quite sufficient allowance for all the items which might be considered on behalf of the large consumer. Although they could

not afford to reduce the figure all round to the price charged for heating purposes, and if they had made the concession in the general rate it would not have been such as would have induced these people to take up the use of gas for industrial operations, the increase in the use of gas for these purposes would eventually tend to the benefit of those who employed it only for lighting, as there was a profit on the manufacture.

Mr. PATERSON asked what difference of rate was found necessary to secure the additional consumption.

Mr. BALL replied that the rate for lighting was 2s. 9d., per 1000 cubic feet, and that for cooking and heating, 2s. For these purposes the gas was supplied through separate meters.

Mr. S. MEUNIER (Stockport) said he thought Mr. Livesey was very near the truth. He had taken the trouble to get out a few figures from his own district, and was rather astonished to find what a difference there was between the summer and winter consumption with certain of the large consumers. He had taken four of their largest cotton-spinning mills, and found the total consumption for the June and September quarters of 1891 (he had taken 1891 because since then there had been considerable irregularity in the cotton industry) amounted to 824,400 cubic feet, while during the December and March quarters of the same year it was increased to 8,840,100 feet; showing that the consumption was augmented by ten to twelve times as much during the winter. They had, however, one or two other industries in Stockport which helped them considerably with regard to the general average. There was a great deal of gas used for what was known as "gassing" purposes; and he had taken four of these firms to examine the difference between summer and winter consumption. These four gassing-mills consumed during the six summer months 7,885,000 cubic feet as against the winter consumption of 13,053,000 cubic feet—an increase of nearly two to one, but a very large reduction from the other case. Then they had the hatting industry. which also assisted somewhat. The figures in that case (also obtained from four firms) were rather more than two to one, as they rose from 2,139,700 cubic feet in the summer to 5,392,300 cubic feet in the winter. It would at once be seen that, if it were not for the assistance derived from these various industries in which gas was used so much more proportionately, the cotton-spinning mills could not be supplied at anything like so cheap a rate; and it also considerably helped the smaller consumers. They had a large proportion of customers—something like 30 to 40 per cent. of the total consumers—among the working classes, whose accounts did not amount to more than £1 a year. It might be said that it was unfair to these hatting and gassing firms not to let them have a reduction or discount in consequence of so nearly equalizing their consumption in winter and summer; and there might be some truth in it. But he could not see that they could make them any large allowance without materially increasing the price to the cotton-spinning mills and general consumers; and he considered it was much fairer to keep an even price. There was another matter with regard to differential rates in the borough and out-districts. They had a difference of 6d. per 1000 cubic feet between the two; but the general consensus of opinion appeared to be that this was rather unfair, and should be equalized as much as possible. In their case, however, he did not know that it could well be done. They had not such an anomalous instance as that just mentioned, where a consumer next door to the works, because he was outside the parish, had to pay so much more than one a mile or two away who was inside, although their borough boundary was somewhat of a zigzag. But they had one or two instances where a special main had to be run some two or three miles into a district where there was a very small general consumption, simply for the sake of supplying five or six large mills using gas (as previously mentioned) so heavily during the winter; so that there was some foundation for charging the extra price. If allowances were made in some special cases, the percentage certainly should not be very large.

Mr. W. KING (Liverpool) thought the discussion showed how difficult it was to generalize. There might be special circumstances arising in certain towns where large allowances would be advisable, whereas in other places, with an equal or even larger population, justice would require a uniform charge. Taking the case of Liverpool, there, at all events, a large proportion of the gas was made externally to the city, and was passed from the out-townships into the centre, just as Beckton gas was brought into London. For the gas burnt in the outlying districts, therefore, round the works, only a small length of mains was employed, and there was a considerable consumption; so that justice would seem to demand that the same price should be charged as in the centre of the city. This plan had been adopted for several years, although previously differential rates between the city and out-townships were charged; and, of course, where the two districts touched, there would be a man on one side of the road at one price, and another on the other side paying more, although he was perhaps nearer the works. They had done away with all this; and now they had one uniform price throughout. This was one of the circumstances in which different towns varied. Then with regard to large and small consumers, it behoved them, in the first place, to look well after the medium and small customers. He might illustrate this from the case of charitable institutions. Anyone who had had to do with these establishments would learn from the Treasurers that they would prefer two subscribers of one guinea each to one of two guineas. If the one man ceased to contribute, there would be a loss of two guineas; but, in the other case, two men had to button up their pockets before a similar loss accrued. So it was with very large consumers. If one big consumer left off taking gas, they felt it; but if they had the same consumption distributed over a large number of people, the loss of one consumer did not affect them to the same extent. He thought, therefore, the consumers of moderate and small quantities were those who should be looked to, both in the present and the future, as their mainstay, that their interest should be considered, and that the price to them should not be kept up by very large concessions to big consumers. The only other point he would refer to was the one to which Mr. Morton and Mr. Foulis had alluded. He was amazed that a gentleman of the known ability of Mr. Newbigging should have made the remark he did with respect to the nuisance of a gas-works. He could not believe that a gentleman of his experience would, in these days, if called in to erect gas-works, fail to give such counsel as would make them, if not a pleasant object in the neighbourhood, at all events absolutely void of any possible nuisance. He should not like it to go forth that the gas engineers of England conducted their works in such an abominable manner that those who resided in the immediate district ought to have their gas more cheaply on that account.

Mr. NEWBIGGING asked permission to add a few words to express his regret that Mr. Morton and Mr. Foulis had taken his little joke so much to heart. It almost bore out the strong charge which Sidney Smith brought against people of a certain nationality. There was no use burking the question. It was all very well to try and make themselves nice and comfortable by avoiding knotty questions. But they had heard in the paper a good deal about justice; and justice should be done all round. He did not mean to insinuate that there was any bad management, or anything like a nuisance, in connection with the Metropolitan gas-works; but they knew other gas-works which could not be exonerated from a charge of that kind. Perhaps Mr. Morton thought that the tastes of people who lived in the neighbourhood of gas-works were in unison with their surroundings, and that therefore they had no cause to complain. But they were "all Socialists now-a-days," and some were even Communists; and it was well to try and mete out equal justice. He should like to add a word on the question of heavy winter consumers. Although they sometimes heard complaints that cotton manufacturers and others burnt in winter a large quantity of gas in a few hours, so putting a strain on the manufacturing power, they never heard a gas manager anathematize any of these consumers; and they would not like to lose a single one of them. There was a good deal of fallacy abroad on this question of heavy consumption in the winter being the occasion of a large amount of capital sunk in unemployed plant in the summer. He did not see anything at all in the argument. It was due to the exigencies of the geographical latitude in which we find ourselves. These people—the large consumers—perhaps only burned gas in the winter; and they paid interest once a year on the capital invested, or once in six months if they did not pay it every quarter. But even taking the small consumers, shopkeepers, and private houses, their consumption in winter was frequently ten times more than it was in

summer; and it would be just as reasonable to complain that a large idle plant had to be maintained in summer to meet the requirements of the average consumer in winter. It was a question of latitude; and therefore complaint was fruitless and unfair.

Mr. C. GANDON (Sydenham) said at first sight it seemed that some benefit should be allowed to large consumers, if only for the reasons that Mr. Livesey had given; but it appeared to him that there was always a difficulty with regard to the differential rates, not only on account of the border-line of outlying districts, as Mr. Paterson had put it, but also because of the border-line in differential rates with regard to price. Supposing that up to 100,000 cubic feet the price was to be a certain figure; and from 100,000 up to 200,000 cubic feet, there was to be a reduction. A consumer who had burnt 100,000 cubic feet had only to use another 1000 feet; and he would get the 101,000 feet for a less sum than he would have had to pay for the 100,000 feet. He had in his mind an example of this in connection with public lighting in a company in which he was interested, and which showed how differential rates sometimes worked. A contract was made for a certain number of lamps; and there was to be a reduction in the price per lamp beyond that number. So soon as the contract was signed, the authorities ordered more lamps; and at the present time they were paying less than was previously paid for fewer lamps. It appeared to him that this difficulty must frequently arise with any differential price. No doubt there might be special cases where it was good policy to make reductions; but, under ordinary circumstances, a uniform price appeared to him to be infinitely preferable.

Mr. C. C. CARPENTER (Vauxhall) said there was one point which had not yet been touched upon, and that was the reference in the paper to a suggestion made by Mr. Vernon Harcourt of a varying price for gas in accordance with its quality. The sale of gas was not very different from the sale of any other merchantable product, such as tea. Suppose a consumer entered into a contract with a merchant to supply him for a year with tea of a certain strength, and supposing, from unavoidable causes, on a few occasions the tea, supplied (say) weekly, was not up to that particular quality, providing the quality was, on the average, above what he paid for, the consumer would not be in any way the sufferer. This was of moment in comparison with the case of the London Gas Companies, who supplied gas throughout the whole year above the average quality required by Act of Parliament; but if, from unavoidable causes, on two or three occasions perhaps, they sent out something which the gas examiner declared to be below the standard, they were at once mulcted in more or less heavy penalties. It appeared, however, to be generally overlooked that the average quality was in most cases considerably above what the consumer paid for. It seemed to him that, if this fact could be recognized, as it had been in the case of the Bill of the Crystal Palace Gas Company, Mr. Harcourt's idea would not be necessary.

Mr. J. HEPWORTH (Carlisle) remarked that anything he might have to say had been pretty well anticipated by previous speakers. He thought Mr. Livesey had proved that, although a common price was desirable, it was necessary in some instances, in order to do justice all round, to make certain variations. He had pointed out more forcibly than he had ever seen before that these variations ought to be limited to (say) 5 per cent.; and, therefore, the principle laid down in the paper was one with which most of the members would be ready to fall in—viz., that the discount should not go to a larger extent than 5 per cent. The special addition which occurred to his own mind (being connected with a Corporation gas-works) was that to which Mr. Newbigging had referred in the case of corporate undertakings. It did seem to him to be unreasonable that, if a corporation had outside their own boundaries a district which was comparatively sparsely populated, the price there should be the same as within the boundaries, because the expense of distribution was in such cases very much larger than it was within the borough; and the risks undertaken were not shared by those outside, but were borne by the corporation who supplied the gas. With regard to the different consumers, his opinion was that, in the case of gas used for cooking and motive power, and of large consumptions such as was said to be the case at Taunton, they might make such a concession as would encourage this consumption still more, and yet do full justice to night consumers. With this slight difference between corporations and gas companies, he should adhere very closely to the principles laid down in the paper, which he was sure would be a guide to them all in their separate capacities when they had to consider this question in the future.

Mr. C. MEIKLEJOHN (Rugby) said he was not in the fortunate position of some gentlemen, who seemed to be so pleasantly situated that every two or three yards they ran against a customer who consumed 4 or 5 million cubic feet of gas per annum; but in his case he had one consumer who took about 20 per cent. of his total output. He should like to ask Mr. Livesey and Mr. Hunt, who were so particular about doing justice to all consumers, whether they would advise him to adopt so strict a rule. The consequence would be that he would simply be following on the lines of the old adage, and "cutting off his nose to spite his face."

Mr. LIVESEY said he thought such a case was met by one observation in his paper [*ante*, p. 871, col. 1].

The PRESIDENT asked Mr. Meiklejohn what were the steps taken.

Mr. MEIKLEJOHN said that, while the discount allowed to ordinary consumers was 2d. per 1000 feet for cash in a month, in this particular case 6d. per 1000 feet was allowed off the selling price.

The PRESIDENT said he thought they had now pretty nearly exhausted the interesting subject before them; and he should not detain the meeting many moments. As he said at the outset, this was more a question for engineers who advised their companies in matters of policy than for gas managers or gas makers; but he might also remind the meeting that The Gaslight and Coke Company's advisers considered that they had no legal right to make any concession in the price they charged their consumers. This was fixed by statute; and it was their impression that they ought to abide by it. He was rather surprised that Mr. Livesey had not suggested any means whereby they might increase the daylight consumption; for he could not help thinking that this was the step which had to be taken. Although it was necessary to supply manufacturing power for the wants of a district in the winter, it must surely be a remunerative policy if they could keep the apparatus fully or partially employed during the summer, or at any rate could increase its work in the summer months. He understood from Mr. Ball that in Rochdale the gas for daylight consumption was supplied through a separate meter.

Mr. BALL said not necessarily for daylight consumption. It was for gas consumed for any other purposes than lighting, whether used in the daytime or not.

Mr. LIVESEY, in reply, said the title of the paper was due to the Secretary; and he thought he had shown his ability in selecting a subject calculated to produce a good discussion. His first remark would be with reference, not to anything said that morning, but to something published last week, in which it was said that the paper would be "combative," and that he was "always a fighter." He repudiated this altogether; for he was not a fighter. He always gave way when he could; and he only fought when he came to the last ditch. He quite agreed with all Mr. Paterson had said as to the difficulty it caused, and the ill-feelings which were roused, if a consumer on one side of a street had to pay something appreciably more than one on the other side. The justice of it was put in a nutshell by the late Lord (then Mr.) Cardwell when Chairman of a Committee in 1866 or 1867. The London Gas Companies at that time had power to charge 6d. extra in the suburbs, or "country districts," as they were called; and Mr. Cardwell said: "It was not a question between the company and the consumer, but between the consumer and the consumer. The consumer in a crowded district could be supplied at a lower rate than one in a sparsely-inhabited neighbourhood." There was no doubt of this; but the extra cost was little more than that of the mains, and it was certainly not worth while to maintain a different price under these circumstances. This brought him to what Mr. Gandon had said about the difficulty of drawing the line. If they began by allowing a discount to consumers of £1000 a year, they soon had to lower the standard; and when it reached £100 a year, other people who consumed less said they ought to have some allowance. Still, there were in the world always difficulties which had to be met

and overcome. With reference to what Mr. Newbigging had said about inside and outside ocal authorities, what he (Mr. Livesey) had quoted rom Mr. Cardwell answered that to a great extent. He did not see that the inside people bore so heavy a responsibility. It was the consumers of gas who carried the burden of the gas undertaking. They paid interest on the capital, and provided a sinking fund; so that there could not be any just ground for an appreciably higher price in the out-districts. As to people living in the neighbourhood of gas-works, he could only say that he had lived on a gas-works during many years, and did not know that any part of his life had been pleasanter. Moreover, gas-works brought a considerable amount of trade, and distributed a large sum in wages; and this helped the neighbourhood. He was not prepared to admit that there was any great disadvantage in living in the neighbourhood of gas-works; and there were sanitary advantages as a set-off. Several remarks had been made with reference to different qualities of gas; Mr. Botley had said the suggestion in the paper would tend to prevent uniformity in the quality. No doubt it was to the advantage of the consumer that the quality of the gas supplied should be as nearly uniform as possible. But his (Mr. Livesey's) contention was that, if the quality supplied were that which could be obtained by ordinary working from the available coal supply, it was likely to be more uniform than where one had to enrich it; and therefore he did not think there would be the variations in quality that there now were. Mr. Carpenter had instanced the case of selling tea. It then occurred to him that they sold sulphate of ammonia on a 24 per cent. basis. It was the same in numbers of cases; a price was paid according to the quality. He thought it would help them out of considerable difficulty in London, and possibly other places, if the initial price depended on the quality. For instance, in London, for 16-candle gas there was a certain initial price; and if the average quality during any half year were only 15 candles, the initial price should be reduced for that half year in just proportion. He had great sympathy with what Mr. Edwards had said; but he thought he had met his case as he had that of Mr. Meiklejohn, because he said there might, "of course, be exceptional cases where it was fair and advisable to make a rather larger allowance than could be defended on exact lines—such, for instance, as concessions which were necessary to prevent the loss of such large consumers as would, if they were lost, detrimentally affect the business, and thus indirectly injure the general body of consumers." For all that, he could not see the justification for allowing heavy discounts. Of course, Mr. Meiklejohn's discount of 20 per cent. to a large consumer who took 20 per cent. of his total make might be considered as a supply in bulk, and would undoubtedly be entitled to more than the discount he had mentioned. If such a customer were lost, the others would have to be charged at a higher rate.

Mr. Meiklejohn remarked that it was only fair to say that this consumer was supplied by a special main direct from the works.

Mr. Livesey said that was, no doubt, a very special instance. Mr. Edwards had stated that in his case there had been very little addition to the capital; but he could not quite understand that, although his number of consumers had increased very considerably. Surely, if the business had grown to the extent he had said, he must have increased his retorts, gasholders, plant, and everything else.

Mr. Edwards: It has not increased for fifteen years.

Mr. Livesey: In that case, the works must have been a great deal too large fifteen years ago.

Mr. Edwards remarked, that it was the proportion of gas sold during daylight which enabled them to get a much larger output from the same plant. They sold practically one-third as much in summer as in winter.

Mr. Livesey said he thought Mr. Edwards's case was one to which Mr. Gandon's remark would apply. He began by allowing discount, and did not know where to stop; and he had gone rather farther than the justice of the case required. He considered, moreover, it was unfair to the small consumers, as it must have prevented reductions in the price to them by making these large allowances to others. The small consumers had not increased in number or consumption as otherwise they might have done. He agreed with Mr. Foulis that they ought to encourage the small man. He would say further that, if any favour were to be shown, it should be to the poor rather than to the rich, who were well able to take care of themselves, which the poor could not do. Moreover, it was good policy to cultivate the small consumer. Mr. King some time ago said he would like to stand still, and thus avoid the trouble of an increase of business. But, by the irony of fate, he was the man who had developed the small consumer more than anybody else; for in the last twelve months, it was reported, he had put up about 8000 of the new coin meters. He believed it was to the small consumers that they must look. He had been astonished at the consumption of gas which took place by small consumers through the agency of these meters. Then the question was raised as to whether or not it was fair to charge them the same price as the ordinary consumer. Of course, they must include in the price of gas the meter-rent, whatever it might be, and the rent for the fittings, if they were supplied; but he believed it would be found that those consumers were quite willing to pay what was right and necessary. They did not, in his experience, object to pay for their gas a sufficient price to cover the cost of the fittings and the meter.

Mr. Botley remarked that his question was with regard to the effect of these charges on the sliding scale.

Mr. Livesey (continuing) said that Mr. Botley was too much of a lawyer. The best way was to give those gentlemen a very wide berth; and, if a thing was right, to do it without asking their opinion. He should say unhesitatingly that, when they charged a large consumer the same price as a small one, they were really making him pay more for his supply than the small consumer, because the cost of administration was less. With regard to the sliding scale, they need not trouble about that. Certainly, if the shareholders were too greedy, it would be rather a check on their greediness; but he did not think it would be right to take the average price at which the gas was sold, if a discount were allowed. If the discount reduced the average price by 1d. per 1000 cubic feet, which was unlikely, it would not be fair or right, supposing the initial price were 3s. 6d., and the selling price 3s., to say that, as the discounts made it average 2s. 11d., they were therefore entitled to pay another ¼ per cent. The price at which the dividend was calculated should be the nominal price at which gas was sold; the discount was something beyond that. The increased dividend under the sliding scale was too big already in some cases; and it certainly was not to the interest of gas companies to swell that dividend unduly. If they charged more under the penny-in-the-slot meter system, he did not think that affected it either. That was not the price of the gas; it was the rent of the meters and the fittings. Mr. Ball had said that the concession was too small—that it would only amount to 1d., and would have no effect. But on this point, he (Mr. Livesey) could give his own experience. Some ten or twelve years ago, a large firm paying £1500 a year sent their representative to him to say that they ought to have 5 per cent. discount, which was only 1½d. per 1000 cubic feet, such as was allowed to railway companies. He said he must admit the fairness of the claim; but the difficulty was where to draw the line. If he allowed a discount to them, some other large consumers might want discount also. His visitor said he could not help that; but he might tell him that his firm were installing the electric light, and, if this discount were not allowed, they would have such a strong sense of injustice that they would put the light all over their very large premises. The Directors considered the matter, and agreed to give the discount; and by this means they stopped the extension of the electric light there. If people thought gas companies treated them with injustice, they would feel annoyed, and determine on having the electric light whatever it cost. The discount of 5 per cent. which the South Metropolitan Company allowed to consumers of more than a £1000 worth of gas a year satisfied them. They had the feeling that they were treated fairly; and with this concession they were content. He had not had any application whatever for a larger discount. He quite agreed with making allowances for gas employed for industrial purposes, particularly in the instances mentioned by Mr. Edwards, of ironers who used gas all the year round; but where, as in the case of large cotton spinners, it necessitated a considerable increase of plant just for one or two months' use in the year, it was not fair to make these large allowances at the expense of other people who used gas for lighting. What brought gas companies

into existence? It was to provide gas for lighting. As to saying they had the mains lying idle—Who paid for the mains but the people who used the gas for lighting? The night consumers, having provided the mains, might claim some advantage for allowing their mains to be used in the daytime.

Discussion on the Papers by Professor Lewes and Mr. Glasgow on Carburetted Water Gas.

The President, in inviting discussion on these papers, said it would be well if Mr. Goulden would give the actual figures showing what the plant at Beckton could do and had done.

Mr. T. Goulden (Beckton) said the plant at Beckton now consisted of twelve generators, with their accompanying sets of plant. The nominal capacity for which it was put up was 6 million cubic feet per day; but, in general practice, they were nearer to 5 millions. At the present time they were working six-minute "blows" and six-minute runs consecutively, with intervals at every eight hours of about forty minutes for clinkering. They thus had during the day about 110 makes, each of which produced 3700 cubic feet of carburetted water gas, which came out to a little more than 400,000 cubic feet per apparatus per diem. The time of shifting the valves was included in the six minutes for the runs and stoppages. A reference was made by Professor Lewes to the statement made at the 1892 meeting of the Institution, in a paper read by Mr. A. M. Paddon and himself: "As the result of matured experience of its working, they gave 5·6 gallons of oil as the necessary quantity to yield 1000 cubic feet of 24·68-candle power gas, or an efficiency of 903 candles per gallon." He subsequently alluded to this result in these words: "Comparing these figures [Dr. Leonard Thorne's] with those given by Messrs. Paddon and Goulden for the best results obtainable for the Lowe process, they show a saving of 22·2 per cent. in the oil used." Now, that was nothing like the "best" result obtained by the Lowe process. It was the average result of working at Beckton at the time of writing the paper in 1892. They were now doing far better; for 903 candles per gallon were obtained from a very rough distillate of Russian crude oil. It was found to be altogether a bad oil to work with. But they had it, and had therefore to make the best of it; so they roughly distilled it, and worked it in the apparatus. He was glad to say it was now all used up, and they would have no more of it. The result at present obtained was very different indeed. Taking a fortnight's working lately, they had 1082 candles per gallon; and taking Dr. Leonard Thorne's experiments and figures—viz., 3·75 gallons of oil per 1000 feet of 20·7-candle gas—he found it worked out to 1104 candles. Comparing 1082 candles at Beckton with 1104 candles, instead of a saving of 22 per cent. in the oil used, it was only 2 per cent. Professor Lewes went on to say that since then further figures had been obtained, which showed practically a double saving; so that the ultimate economy on the experiments lately made would be 4 per cent. They arrived at their figures at Beckton on a working scale; whereas Professor Lewes's were obtained on an experimental scale. If they were to personally superintend the plant, and watch it continually, he had no doubt they would far exceed the results given by Dr. Thorne. He (Mr. Goulden) was quite content to take his estimate of the cost of 25-candle gas, which was as nearly right as possible; but this reduced to 16¾-candle gas would give as a figure of cost into the holders 1s. 3d. per 1000 cubic feet, which he submitted must be taken as a very fair result. With regard to the tar, they were able to burn it under the boilers; and they were now distilling it at their chemical works, and disposing of it satisfactorily. Consequently, it was not quite such an unmitigated nuisance as it was represented to be. Of course, it was a nuisance, because it contained so large an amount of water; but still it could be dealt with. As to the "bogey," carbonic oxide in the gas, in London, at any rate, they would never use carburetted water gas, except to enrich coal gas, and therefore the quantity of carbonic oxide was not a very important factor. If they took coal gas as containing 8 per cent. of carbonic oxide, which was the figure according to his experience, and the quantity in water gas as 29 per cent., and taking the carburetted water gas as equal to about 10 per cent. of the total output from Beckton, it would give a total result of 10·5 per cent. of carbonic oxide in the mixture, which was certainly nothing to be afraid of. Even with the Lewes gas itself, with a much larger quantity of hydrogen, if they took a percentage of this equal to the carburetted water gas they were sending out mixed with coal gas from Beckton, reckoning it at 15 per cent., in the resulting mixture there would be 8·7 per cent. of carbonic oxide—a difference of only 1·8 per cent. from that now being sent away, and one which was not worth talking about. He was not very conversant with the Lewes apparatus; but it seemed to him that the heated surface for cracking the oil was too small to perform that function satisfactorily. Of course, it was very desirable to get the ethylene away as quickly as possible from the heated surface which produced it from the oil. But it must be produced in the first place; and this could not be done without a sufficiency of heated surface. There was another point he thought worth calling attention to, and that was that there would be more sulphur in the Lewes gas than in that made by the Lowe process; and for this reason: The sulphur evolved by the gas produced by the Lowe process came from the coke only during the operation of gas making; also a little from the oil. In the intervals of blowing up, all the sulphur from the coke escaped into the atmosphere. Here, on the other hand, he should think one would not only get sulphur from the coke and oil during gas making, but the sulphur evolved from the coke in the process of blowing up would be taken up by the iron, and would probably be evolved from it by the steam in the process of gas making also.

Mr. G. E. Stevenson (Rochdale Road, Manchester) said that everything connected with the apparatus for enriching gas and gasifying oil, whether by producing water gas or enriching coal gas by the use of oil, was of great importance at the present time; and he should like to get some idea as to which was the most economical way of doing it. He had been very much interested in the papers read, especially in that of Professor Lewes, who had given the cost of making water gas at Beckton, but had not stated the cost of making it by his own experimental process, otherwise than by saying that a saving of 22 to 40 per cent. was effected in the use of oil. He should be much obliged to him if he would say if he could give the members the cost per 1000 cubic feet of producing carburetted water gas of a certain illuminating power with this apparatus. In the meantime, he (Mr. Stevenson) would take the cost at Beckton at 2s. per 1000 cubic feet for carburetted water gas of 25-candle power. During the past winter, he, in common with many gas makers, had been taking steps in the way of enriching gas with petroleum vapour by the use of the Clark-Maxim apparatus; and, on going into the question lately, he made a calculation of the amount of oil needed for bringing up his gas to the standard required in Manchester, which was 20 candles. He found that, with the process in operation at Beckton, it would be necessary to use, with 18½-candle gas, 60 cubic feet of the water gas to each 1000 cubic feet of coal gas to bring it up to 20-candle power. If this were correct, the cost would, as far as he could make out, be 1·5d. per 1000 cubic feet, or 1s. 3d. per ton of coal. This was a very considerable cost. He did not know whether or not it could be done more cheaply; but by the Clark-Maxim apparatus they did it at a very much less cost than that. In fact, during the experiments made last month, extending over ten days, in which the spirit used was carefully measured, and the illuminating power of the gas tested at short intervals, they found they were able to do it at a cost of 6⅛d. per candle for 10,000 cubic feet; the consumption of spirit being 1·35 gallons, or a little more than 0·6d. per 1000 cubic feet per candle.

Mr. Paterson asked if the tests were made at the point of carburation.

Mr. Stevenson replied that they were conducted at a very little distance. At the same time, experiments were made to ascertain whether or not the gas carried its illuminating power to a distance; and at half a mile there appeared to be a reduction of 0·4 of a candle. At two miles, testing with a jet photometer, the reduction did not appear to be more than 1 candle. He said, of course, it did not "appear" to be, because tests taken in that way were rather difficult to be certain about. But even supposing the consumption of spirit to have been more—if it were 1·8 gallons—it would not have exceeded in that case about 8d. per candle for 10,000 cubic feet, as

the cost of the spirit was 4½d. per gallon when all the expenses were paid. The specific gravity of the oil was ·697. He should like to hear from Professor Lewes what he thought would be the cost of raising 18½-candle gas to 20 candles by mixing carburetted water gas with it under the most economical method.

Mr. T. S. LACEY (Pimlico) said he had used carburine for three months to bring their ordinary coal gas up to 20-candle power; and his experience was that, for this apparatus, between 40 and 50 gallons of spirit were required to replace a ton of Lesmahagow cannel. The absolute quantity of gas made from a gallon of carburine was about 30 cubic feet. As he had said once before—and the fact had since been acknowledged—it was not reasonable to expect a larger make from a hydrocarbon of this character. He was surprised to find such results as those stated could be obtained from 1·35 gallons of carburine, or any spirit of that class, as it did not correspond with his experience. He thought if one could get from 1¾ to 2 gallons of oil per 10,000 cubic feet to give one candle, this would agree with the experience of most of those who used this material. It had great advantages, no doubt, because it could not only be put on when wanted but also taken off whenever it was not required. If the cost of the material was only 4½d. per gallon at Manchester, he thought it would pay to import it to London. The price in the Metropolis was never less than 9d. per gallon; and he should advise Mr. Stevenson to continue as he was working, for he did not think he would gain very much by a change. He should like to ask Mr. Goulden the candle power of the gas he alluded to, of which he obtained 1082 candles per gallon of oil. It was probably somewhere about 25 candles.

Mr. GOULDEN said it was 24·5 candles.

Mr. LACEY remarked that there was no doubt the number of candles per gallon one could get when working at a rather lower illuminating power was greater than it was at a higher standard—say, 25 or 30 candles.

Mr. GOULDEN said that, when the plant was worked to its utmost capacity, making gas of as high illuminating power as possible—say, 30 candles—it was almost impossible to avoid wasting a little oil, which had to be blown away at a stack-valve, because more oil had to be put into the apparatus than was thoroughly cleared out with the water gas.

Mr. LACEY said one could easily understand this, provided that, in making gas of 40-candle power, you could get as many candles per gallon as in making 20-candle gas. If the oil were being used merely as an enricher, the richer it was the better. In such a works as Beckton, it did not pay to make water gas to compete with coal gas. In other places, perhaps, water gas might more approximate to coal gas in cost; as, for instance, at Kensal Green, where they made gas of 19 to 20 candle power. There they could get a higher number of candles per gallon of oil than at Beckton, where they made a richer quality. It was a very unfortunate thing, but one could not compare gas of 20-candle with another gas of (say) 30-candle power, and say there was any direct relation between the two. The illuminating power of gas was not really a definite quantity. A few days previously he was testing an oil gas with several burners; and he could conscientiously make the gas either 40 or 44 candle power. It was quite possible, in some cases, to have differences of 10, 15, or even 20 per cent. in the lighting value of the gas; and it was very difficult to say what was the absolute illuminatiug power of a rich gas. It was taken as the best one could get with the burner thought to be most suitable for the particular gas. It was not to be wondered at that rich gas, such as was used in the Young process, gave an enormous illuminating value when calculated by its enriching capacity when mixed with other gas. For instance, 50 or 60 candle gas, when tested with a flat-flame burner, might possibly, if it were to be calculated when mixed with some other gas, appear to be 100 candles or more. This point should not be overlooked when they were testing the illuminating power of a gas—not directly, but indirectly by its value for mixing with some other gas. It was therefore quite necessary that some caution should be exercised in comparing these things. There was little doubt that, if they took a gas of about 20-candle and another of about 30-candle power, and mixed each of them with gas of low quality, and tested their enriching power, the richer the gas was, the greater would be the tendency to depreciate its value when tested alone; and probably gas of 40, 50, or 60 candle power had not had fair treatment in testing, because they were not in the habit of supplying it, and nobody had taken any great trouble to devise burners for getting the best results. Last year he raised questions which he was glad to see that Mr. Glasgow had answered. It appeared now that it was impossible to avoid some waste in steam and carbonic oxide; but, if the particular nature of the oil and fuel used could be fixed, the proportions of the apparatus could be so adjusted to the conditions under which it was used, that it might be possible to avoid the waste of heat by sending the carbonic oxide into the air.

Mr. W. FOULIS (Glasgow) said he thought that oil gas must be looked upon as simply a means of enriching coal gas, and that there was not much likelihood, as in America, of towns being supplied with oil gas exclusively. The question, therefore, came to be what was the best form in which it could be so used. Of one thing he was fully convinced—that the apparatus most likely to be effectual generally, was the one which would enable oils of any gravity, however coarse, to be utilized. If they were to be confined to oils of (say) ·845 or ·850 specific gravity, or oils of which there was only a limited quantity on the market, and of which the prices were already as high as gas makers could possibly afford to pay, there was not much chance of the process being largely adopted. Another question which had yet to be decided was whether or not this enriching had better be done with oil gas, pure and simple, or with oil gas diluted either with carbonic oxide or with hydrogen and carbonic oxide, or in any other way. It was somewhat difficult to see what advantage could be derived from mixing the oil gas with these other gases; but Professor Lewes might have found in his experiments that they tended to develop the light of oil gas. He had had an opportunity during the previous week of seeing the Young process of manufacturing oil gas at Peebles; and, although it was on but a comparatively small scale, as far as he had seen it was the only process which enabled thick oils of almost any specific gravity to be successfully worked up into permanent gases. The process there was more in the nature of distillation than of cracking. The heat was very low; and the gases seemed to be carried with considerable rapidity from the retort by the large volume of hydrocarbon vapour.

The PRESIDENT asked if Mr. Foulis was quite sure they were permanent gases. It seemed rather contrary to the general practice.

Mr. FOULIS said his reason for saying so was that the gas was so thoroughly washed with oil that he could not believe any gas not permanent would pass the washer. It was well known that, if any gas was washed with oil, all the denser hydrocarbons were washed out of it. Of course, he had not had an opportunity of testing its actual permanency. He was assured, however, that the gas remained constant, even in the coldest weather; and his own impression was that the gas as made would be permanent. He was much impressed with the process Professor Lewes had described; and, if it could be carried out practically, it was one by which the heavier and cheaper oils might be utilized, which, as he had already stated, was a point of great importance. A number of comparisons had been made between different processes, as to the value and candle power; but, unless the quality of the oil used was known, such comparisons were not, in his opinion, worth very much.

Mr. HUNT asked Mr. Goulden whether the improved results he gave as having been obtained at Beckton followed the introduction of the alterations named by Mr. Glasgow in his paper.

Mr. GOULDEN said the improvement in their results was obtained by the use of a better class of oil.

Mr. HUNT said it might therefore be inferred that a further economy would follow the introduction of those improvements, which would bring the cost of the Lowe process below the figures given. He had had the pleasure of seeing the Lewes apparatus at work at Aldershot not long ago; and it impressed him as being very simple and admirable for the purpose intended. But to his mind it was less a question of different processes of this kind, than one as to whether or not any such process was the right one to adopt where oil was, as in this country, an expensive commodity. Mr. Foulis had said very justly

that carburetted water gas had no chance of being adopted here so universally as in America; and that it would be used, if at all, as an enricher. But he (Mr. Hunt) would go farther, and say that the chief value of such a process in England would be the amount of the enrichment obtained from the oil employed. The comparison, therefore, should be between the illuminating power and value obtained by such a process as either of these, and that resulting from ordinary gasification of oil. He understood that a very high lighting value was obtained by the process adopted at Peebles from the oil in use, with residuals having a market value. Were this established, it would go far to justify the method of gasifying oil separately, as against carburetting water or any other gas. Again, in the Lowe process, the residuals were a source of trouble, which Professor Lewes overcame by burning them up. But surely one ought to aim somewhat higher than this, especially if the residuals derived from gasifying oil could be obtained in such a form as to be of some value. It would be remembered that experiments had been conducted at the Windsor Street works during the past eighteen months, with the view of proving the accuracy of the ideas put forth by Dr. Dvorkovitz, who took part in the discussion upon this subject last year. Dr. Dvorkovitz claimed that, by limiting the contact of the vaporized oil to just a sufficient amount of heated surface to gasify it, the residual oil became of greater value; being partly converted into benzol. He was now able to say that this expectation had been verified to a large extent. He had the opportunity not long ago of testing this method against the ordinary one of gasifying oil. He had been in the habit of using a cast-iron retort 6 inches in diameter by about 7 feet in length; the oil passing in at one end, and the gas coming out at the other. The method adopted by Dr. Dvorkovitz was to pass the gas through wrought-iron tubes of comparatively small diameter (in this experiment, 3 inches); and the result showed a marked difference in the residuals. Practically, the same amount of illuminating matter was obtained from the gas by both appliances, but not quite so much residuum by that of Dr. Dvorkovitz as in the ordinary retort. It was, however, of a higher market value—of such a value, in fact, as would, if the process were practicable, reduce the cost of oil gas considerably below the figures given that day, and even enable it to compete with coal gas. Mr. Goulden cited some figures giving the cost of water gas made by the Lowe process at about 2s. per 1000 cubic feet for 25-candle gas; and these were the figures given by the President in his address that morning. Mr. Goulden deduced from this that 16½-candle gas would come to 1s. 3½d. But this could not be claimed as any particular economy. He imagined that many of those present had to make 16½ and 17 candle gas at a considerably less cost into the holder; and taking the ordinary cost of such gas, and deducting it from the 2s., he inferred that the expense of enriching gas from 17 candles upwards would be something like 1½d. a candle. This, again, compared unfavourably with the cost of cannel; so that he was afraid they could not consider the carburetted water-gas process as it was at present a sufficiently economical one for ordinary use, even regarded as an enricher. Mr. Foulis had expressed his opinion that no apparatus would give satisfaction unless it could deal with the crudest and commonest of oils. There was much to be said in favour of this view. But he doubted very much whether satisfactory results could uniformly be obtained by using the commonest oil; and, having regard to the comparatively low cost of distillation, he inclined to the opinion that the oils should be prepared. It might be a heavy oil; but it should be prepared by distillation, and freed from carbon, as far as practicable, before use. Mr. Lacey had mentioned the difficulties experienced in properly assessing the value of oil gas of high illuminating power. He referred to this matter last year, and pointed out that oil gas of 70 or 80 candle power was not done justice to by the ordinary method of testing. They had frequently found that, by mixing such oil gas with gas of a lower illuminating quality, much higher results were obtained, to the extent of 20 or even 25 per cent. It appeared evident that the proper way to test gas of high power was to mix it in certain proportions with gas of a known low illuminating value, and test all such mixtures in a standard burner with a uniform height of flame.

Mr. Foulis called attention to the errors that might arise from mixing very rich gases with poor gases. It was exceedingly difficult to get them to mingle at all.

Mr. Hunt said he had done it as a matter of ordinary practice—not testing it immediately after the gases were brought together, but letting the mixture rest for some time; and he had found no practical difficulty.

Mr. Lacey drew a sketch of a very simple scheme he had devised for mixing gases in this way. He explained that it consisted of carrying the gas from one holder into the other by means of an india-rubber tube, ending in a pipe which passed into the second holder. The pipe was perforated with a number of holes, through which the gas was forced by additional pressure on the holder containing the richer gas.

Mr. Goulden said he should be glad if Mr. Hunt would state the value of a gallon of oil dealt with by the apparatus with which he had been working, the number of gallons per 1000 cubic feet of gas made, and the illuminating power of the gas.

Mr. Hunt replied that the oil used, as near as he could recollect, was about ·870 specific gravity; the value would be about 4d. per gallon, obtained in small quantities; and the yield was about 60 cubic feet of 70-candle gas, tested by the most suitable burner they knew of.

Mr. Goulden remarked that according to that the result in candles per gallon was 840, which was much less value for the oil than they were getting at Beckton by the Lowe process.

Mr. Hunt said this bore on Mr. Lacey's objection to testing gas of a very high quality. Much better results were obtained by mixing with gas of a lower quality. The amount of illuminating matter was, however, only one, although doubtless a primarily important factor in the process.

Mr. A. C. M'Minn (Kensal Green) said the conditions at his station were different from those at Beckton. At Kensal Green there were heavy charges on the coal for canal dues, lighterage, &c., that did not exist at Beckton; whereas oil could be delivered as cheaply at the former as at the latter works. Oil gas consequently compared more favourably with coal gas as to cost at Kensal Green than at Beckton; and therefore they were able to use a larger proportion of oil gas at Kensal Green. This enabled them to carry out the enrichment with a larger proportion of oil gas of a somewhat lower illuminating power—viz., from 18 to 22 candles; the average being about 19 candles. His experience had shown him that, by making a gas of this quality, there was not the slightest approach to nuisance through the production of smoke; while at the same time a greater value was obtained per gallon of oil than when making a richer gas. The average illuminating value obtained during the last quarter was upwards of 1250 candles per gallon of oil used; the cost into the holder, allowing 1d. per 1000 cubic feet for wear and tear, being less than 18d. per 1000 cubic feet. With regard to the productive capacity of the plant, when they first started, gas of a rather higher power was made; and they turned out fully half a million cubic feet of gas per set, which was the nominal capacity. Upon reducing the quantity of oil, the production fell off somewhat. But they had improved as they went on; and at the present time the full half million per set, and even more, was frequently reached. It might be as well for him to state that at Kensal Green the whole of the enrichment during the last eight months had been effected by means of oil gas.

Mr. A. F. Browne (Rotherhithe) said this question was very fully discussed at the previous meeting; and in the end he was quite convinced by Professor Lewes that, in order to make oil gas economically, one must gasify the oil in the presence of what the Professor called a "carrier." So much was he impressed with this view, that he ceased to make experiments on the direct gasification of oil, such as he had previously made for the purposes of a paper he read last year. But between that time and a week or two back, it seemed, somehow or other, there was a little doubt in London whether water gas was so successful as had been anticipated; and in the Journal of Gas Lighting on two occasions, a challenge had appeared as to the production of definite statements as to the results that were really being obtained. This question seemed to be now entirely set at rest, not only by the papers read, but also by the statement that the whole of the enrichment of the gas made at the Beckton works was effected by the employment of water gas. But there was one fact which had

come out very clearly that day for the first time—namely, that at Beckton, where a very large quantity of this gas was made, it was used for the purpose of enrichment only. On some former occasions, the question had been complicated by the statement that water gas was to be utilized in other ways, two of which were perfectly clear—one being the occurrence of a fog, because the gas could be quickly made; and the other, a possibly favourable effect on the price of coke. Now, it appeared they had come to the point that this gas was to be made in England for enriching purposes only; and therefore it seemed to him to be a question merely of relative cheapness. Last year, Professor Lewes stated that he attained far greater efficiency from a gallon of oil, if it was employed in the manufacture of water gas, than by gasifying it direct. But, as he (Mr. Browne) understood, there was now a doubt whether circumstances had not changed by the introduction of the Young process; and Professor Lewes had himself admitted that there was a great deal in that process. If this was so, the manufacture of water gas might not last long. They were manufacturers of carburetted hydrogen; and the difficulty was that some of it was not sufficiently carburetted, and they had to bring that small percentage up to the average. The question was whether or not they were to make a large additional quantity of poor gas in the shape of water gas, as the vehicle of enrichment for that small percentage. It seemed to him that there might be some means found by which the intervention of the carrier could be dispensed with, or obtained in another direction. Mr. Good, of Carshalton, Mr. Herring, of Dover, and one or two other gas engineers, had stated that they overcame the difficulty by injecting oil into the retort during the last half-hour of the charge; and if as great efficiency could be obtained from a gallon of oil in this way, it seemed to him that it might be the proper method of doing it. However, this lay in the future. He was exceedingly interested in the apparatus of Professor Lewes; but he should like to ask one or two questions about it. He understood him to say that, having made hydrogen gas, he proceeded to enrich it by the vapour of a light hydrocarbon, as in the Maxim-Clark process. This was a process with which they were very familiar; but he should be glad to know whether or not Professor Lewes found it possible to enrich pure hydrogen gas up to 16 candles by the addition of the vapour of light hydrocarbons, such 16 candles to be yielded by a test with the Referees' standard burner. He thought there was a good deal of difficulty in getting an enrichment much above 16 candles with ordinary coal gas by the Maxim-Clark process. One speaker had said that in Manchester he had enriched 18½-candle gas up to more than 20 candles by the addition of a light hydrocarbon; but this gas, he understood, was tested by means of a flat-flame burner, which made all the difference. It would also be very interesting to know whether the carburation of pure hydrogen with oil gas, as in the water-gas method, produced a richer gas than the carburation of water gas pure and simple; and he did not quite gather when and how the oil to be gasified was added to the hydrogen. With regard to the Lewes apparatus, he should like to ask whether the composition of the gas, as given in the paper, might be taken to be the average that would be made under the most economical working of an apparatus of the kind. It appeared to him that, with regard to the generating chamber into which the oil and the superheated steam were put, the efficiency of the chamber might very easily be lost before that of the iron chamber, or *vice versâ;* and according to which lost its efficiency first would the operation of the next "blow" be regulated. He presumed, however, that this was a matter depending upon the relative areas of the chambers. With regard to oil gas proper, there was a strong opinion in the minds of several gentlemen that it ought to be made direct; but it appeared to be a question between high heats and low heats. As he understood, the gasification of oil direct in retorts was always brought about at a low heat—about 1100° to 1300° Fahr. Professor Lewes had spoken of high heats; and so did all the manufacturers of water gas. He should be glad if the Professor could tell him something more about this, and say whether, in view of the Young apparatus, he thought that oil gas could be made at a low heat equally cheaply with water gas made in the Lewes apparatus.

Mr. Stevenson asked what Mr. Browne meant by saying that testing with a flat-flame burner was totally different from testing with an Argand. His idea was that gas did not give so high a result with the former as with the latter.

The President: It is all a question of quality.

Mr. Stevenson said he presumed that gas showing 20 candles with a flat-flame burner would, if tested with complete combustion in an Argand burner, show still higher results.

Mr. Browne pointed out that they were tied in London to a consumption of 5 cubic feet of gas per hour. If they could reduce the quantity of gas, and calculate the amount burnt, undoubtedly they would get as high a result as with a flat-flame burner. He would remind the members that the testing of the cannel gas at one time supplied in London was conducted by means of flat-flame burners.

Mr. Stevenson observed that the difficulty had always been to ensure complete combustion of a rich gas with an Argand burner consuming 5 cubic feet an hour. There could be no difficulty, he apprehended, in carburetting hydrogen up to 14 or 16 candles with light hydrocarbon vapours, because it was well known that atmospheric air could be so carburetted by the vapour of gasoline.

Mr. M'Minn said one remark of Mr. Browne's was, he thought, hardly borne out by the discussion—namely, that oil-gas plant could only be employed for purposes of enrichment, and that the idea of using it in cases of emergency was altogether given up. The plant was easily got ready—much more quickly than retort-settings; and it would be found very useful, on an emergency, to be able to make large quantities of gas at short notice.

Mr. C. C. Carpenter (Vauxhall) said this was a very important point. He should like to know how long it would take to get a plant ready to turn out gas, because fogs came on very rapidly in London.

Mr. Goulden stated that they had laid out the water-gas apparatus, and got it ready in four hours, for making half a million cubic feet per day.

Mr. Browne said he regretted he had misunderstood the statement he had read to the effect that the water-gas plant at Beckton had been in full operation during the past year, and that all the necessary enrichment of gas made there was effected by it. This gave him the impression that the whole of it had been required for enrichment. It appeared, however, that he had jumped to an erroneous conclusion.

Mr. A. G. Glasgow said he had some very considerable comments to make on Professor Lewes's paper. So far as the Professor confined himself to describing his own apparatus, and built his edifice on his own ground, he had not a word to say. If he built on a good foundation, it would stand as a monument to his credit and a benefit to mankind; but if the foundation were poor, the building would in course of time tumble down, and all other people had to do was to stand aside. But when Professor Lewes left his "family circle" and strolled abroad for an effective background to his "infant progeny;" when not finding existing records to his liking, he deliberately tore from the product of 18 years' gigantic growth its workmanlike habit, and in lieu thereof draped its sturdy, well-developed frame in sackcloth and ashes; when, not content with leading the Lewes process to the baptismal font, he in the same breath condemned the hitherto lusty Lowe to the mourners' bench—he (Mr. Glasgow) submitted that it was time to examine the facts. He would remind those present that during the past year the daily output of illuminating gas in the United States and Canada was approximately 60,000 million cubic feet—40,000 millions being carburetted water gas. Of this 40,000 millions, 30,000 millions was made under the Lowe system; and the percentage was increasing monthly. That the records of these companies were freely open to English visitors of standing, several gentlemen in the room could testify. That the directors of these 350 companies united in dressing a single process in fictitious figures, was not likely. A gentleman responsible for every detail in the operation of some 40 American gas-works—Mr. Alexander C. Humphreys—having just completed his annual analytical statements, had recently written him that at four of the largest of those works, reckoning on the oil bought and paid for, and consequently including all discrepancies, the year's result exceeded 1450 candles per Imperial gallon of the cheapest oil it was possible to

purchase in America, regardless of quality. The lowest results obtained were at miniature works making only 10 millions yearly, and exceeded 1150 candles. But American results, he imagined, had merely an incidental interest there. He could find in London all the facts his argument required; and in order that he might not repeat himself, and not omit anything he wished to refer to, he had in his hand a rough draft of the criticisms he should offer, which, if in order, he would read.

The PRESIDENT expressed his assent to this course.

Mr. GLASGOW then read the following comments: As we have seen, Professor Lewes ignores a snug little plant at Kensal Green of 3 millions capacity daily, and obtaining regularly upwards of 1200 candles per gallon of oil. We have further seen that his estimate of the capacity of the Beckton plant is utterly worthless. To emphasize this point, I may say that the firm with which the writer is connected are now constructing some generators of the same diameter as those at Beckton, each under a rigid guarantee to produce regularly 750,000 cubic feet daily; and the actual make will easily exceed this figure by 10 per cent. I note that the United Gas Improvement Company should be substituted for the Lowe Company; and the figures "903 candles per gallon" should, I think, be 882 candles. The statement is rightly made that Mr. Goulden and myself gave the illuminating value of a Solar Distillate, having a specific gravity of ·860 and a flashing-point of 130° Fahr., at from 1300 to 1360 candles per gallon. I have never since had occasion to use this oil; nor, I believe, has Mr. Goulden, except when mixed with heavier oils. This part of the paper is so misleading, that I feel obliged to relate a little ancient history. When more than two years ago the United Gas Improvement Company erected plant at Beckton, it was put into operation with a Russian mineral oil known as Novorissisk (sp. gr. ·956, flashing-point 170° Fahr.), containing 8 to 10 per cent. by weight of free coke, left as a residue upon distillation. It was promptly found that this oil could not be handled commercially; and as a considerable quantity had been purchased, arrangements were made for a rough distillation. In the meanwhile the sample of Solar Distillate above referred to was tried, with the results quoted. The 1892 paper of Messrs. Goulden and Paddon dealt exclusively with the Novorissisk Distillate, the successful use of which oil in the proportions given reflects, in my opinion, considerable credit upon the Company and their Engineers. Professor Lewes, however, takes these figures as the best result of the Lowe plant, still further reduces these authoritative Novorissisk figures by 12 to 15 per cent., and gives the net result as the average Beckton working with a Solar Distillate of ·860 specific gravity and a flashing-point of 130° Fahr. With such a pessimistic mental bias in his examination of the Lowe process, I hardly wonder that he has characterized my views as "rosy." I shall now beg leave to lay by the side of the estimate of the average cost of 22-candle Lowe gas—not a "rosy" estimate of what results may or should be reached, but some hard-and-fast figures upon which a fairly respectable firm will contract to furnish Lowe plant under rigid guarantee. They concern the first two items only. Instead of 5·75 gallons of oil, read 3·75 gallons; and instead of 60 lbs. of coke, read 50 lbs. With the other items unchanged, the total 2s. o$\frac{3}{4}$d. is reduced to 1s. 6d. It may be well to mention, too, that there are oils that can be lawfully brought into England other than Solar Distillates; and that the above figures can be guaranteed with an oil costing, at any United Kingdom port, considerably less than 3d. per gallon *ex* tank steamer. Referring to the tar, if the tar market does not justify treatment of this residual, it makes a valuable boiler fuel, as those who have used it know. A word about carbonic oxide. Carburetted water gas, of from 20 to 30 candle power, will contain from 25 to 30 per cent. of this gas. As far as its poisonous character is concerned, Professor Lewes finds that, under certain conditions, it is perfectly possible for this percentage to be a source of danger. Unquestionably; but under these same conditions—*i.e.*, a small room with a 6-feet jet on, and unlighted—he says that coal gas, with but 3 to 6 per cent. of carbon monoxide could not possibly reach the limit of danger. Yet, as a matter of fact, people are fatally asphyxiated by coal gas under precisely these conditions, although not, it is true, by the carbon monoxide contained therein. This being true, it is difficult to see what substantial advantage, in the direction of safety, a gas containing 15 to 18 per cent. has over one containing 25 to 30 per cent. This whole question has been long since settled in America, upon the principle that "the proof of the pudding is in the eating." Concerning carbon monoxide as a diluent, it is certain that marsh gas is the best diluent; and the reason is not far to seek. It is itself a hydrocarbon of considerable illuminating value. Between hydrogen and carbon monoxide, I am not qualified, by personal knowledge, to judge; but Professor Lewes's opinion is deserving of respect. At the same time, there are those of knowledge and experience in this matter who take a directly opposite view. This much may be said: Carburetted water gas is the only gas of 30-candle power that can be burned with perfect comfort and cleanliness in ordinary 6-feet flat-flame burners. Ordinary coal gas will begin to smoke long before it is enriched to that luminosity. What is the reason of this? Coal gas contains twice as much marsh gas (CH_4) as water gas, and considerably more hydrogen. Why, then, can it not carry more illuminants? It looks as if the superiority of water gas in this direction must be due to its carbon monoxide. I am occupying so much time that I turn now to the end of the paper, where Dr. Thorne's results show a yield of 1100 candles per gallon of oil, which, it is stated, is a saving of 22·2 per cent. over the best result obtainable by the Lowe process. Considering that, upon the occasion when this same oil was used exclusively, the results from two different sources were 1311 and 1356 candles respectively, and that several works are being now installed under a guarantee of 1200 candles per gallon of oil (which result is being regularly exceeded at Kensal Green), the claim of a saving in oil seems somewhat unsubstantial. As far as the analyses are concerned, it would be more interesting to see those of unpurified gases. However, a glance at the Lowe column in the table shows the analysis of this gas to be incorrect. By the principles of its manufacture, it is impossible for the gas to contain as much carbon monoxide as hydrogen. Perfect conversion of the steam yields equal volumes of hydrogen (H_2) and carbon monoxide. But, as a certain proportion of carbon dioxide is invariably formed, reducing in twofold ratio the volume of carbon monoxide; and, further, since the gasification of the oil always liberates a considerable quantity of hydrogen, it is invariably found that a gas containing this 29 per cent. of carbon monoxide will have 35 to 38 per cent. of hydrogen. As would be expected from the above, the proportion of marsh gas shown is correspondingly high. It is to be noted, in this connection, that a low percentage of carbon monoxide will always result from improper conversion of the steam. Suppose, for instance, that Professor Lewes's unpurified gas contained 7$\frac{1}{2}$ per cent. of carbon dioxide. This, if properly converted, would have yielded 15 parts of carbon monoxide, which would then have been present in the proportion of 3 parts of carbon monoxide to 4 parts of hydrogen—just about their usual relation in Lowe carburetted water gas. This 7$\frac{1}{2}$ per cent. of carbon dioxide would have to be removed by expensive purification. My defence of the Lowe system will not be complete unless I point out that many efforts have already been made to use the generator fire for fixing the oil, and iron for the production of the diluent. I may quote, for example, from the patent specifications of J. E. Leadley, of Nov. 27, 1883: "At the time of heating up the fuel chambers, hot gaseous products containing carbon monoxide are passed up through the oxidized metal scrap in the iron chamber, and de-oxidize it. The carbon of the carbon monoxide, uniting with the oxygen of the oxidized metal, reduces the latter to a metallic state, so that it will be again in condition for decomposing steam." I mention this early work because of the bearing it has upon the practicability of the Lewes system; for, while I do not know at the moment to what extent Messrs. Hanlon and Leadley carried out in practice the portion of their process indicated above, I do know that their so-called improvements were gradually eliminated, until their apparatus approached so nearly the standard Lowe, that the latest purchasers have paid heavy damages for infringing the Lowe patents, while its builders have retired from this line of business.

Professor LEWES, in reply, said in this case, as in many others, the sting had been found in the wasp's tail. Mr. Glasgow, the very able advocate and representative of the Lowe plant and method of working, had certainly

brought forward many interesting points. When he commenced with his extremely beautiful metaphors, he (Professor Lewes) felt that he was going to be knocked utterly out of time; but, as Mr. Glasgow continued, he began to have hopes that there might be something to say in return. He could assure Mr. Glasgow that he did not doubt that, in other parts of the world, water gas was not only holding its own, but entirely ousting coal gas and other illuminants from the field; and in the references he had made in the early part of his paper, he alluded simply to the work which had been done in England. It must be admitted that he was perfectly justified in taking the only figures he could get—the figures given by Mr. Glasgow himself, and those contained in the paper afterwards brought forward by Mr. Paddon and Mr. Goulden. He regretted that he had not a copy of them at hand, because the error which apparently he had fallen into was that the figures he had given referred to a different class of oil. He had used the figures because he imagined that the same class of oil had been employed throughout. Unless his memory played him false, Messrs. Paddon and Goulden spoke of Russian distillate oil. It might be that, in taking those figures, he had inadvertently mixed the Russian Distillate with Solar Distillate; but there was the fact that Mr. Glasgow, in introducing the plant, spoke, as he had every right to speak, of the work being done in America, and of 1346 candles being obtained per gallon of oil. Mr. Goulden also gave 1311 candles obtained per gallon of oil; and then they gradually had to drop, until in Messrs. Paddon and Goulden's paper they gave the figure as 903 candles, which, as now explained, was from an inferior kind of oil. But taking the figures originally given—1346 candles—he conceived these figures were obtained while using anthracite, and the temperature one could obtain with it. The result as now given by Mr. Goulden, with good working, was 1082 candles for 24·5-candle gas at Beckton; and 1250 candles was given by Mr. M'Minn as the average for 19-candle gas at Kensal Green. These figures had been distinctly surpassed in the amount of light obtained by processes for cracking oil by itself, and also by that little apparatus of his. Working, as he said, under considerable disadvantage, he had gone as high as 1600 candles per gallon. Whether or not, when the plant which Mr. George Livesey had given him the opportunity of erecting on a large scale was working, at equal temperatures, it would produce those figures, no one could say; but he hoped, having got them under great disadvantages, they would find that, under proper conditions of working, they would be maintained. In Mr. Goulden's criticism, he said that the figures given should be 2 per cent., and not 22; and he then went on to say that, therefore, the best figures would be 4, and not 40 per cent. Now, this was an error. His best figure was 1600; and that would be a very high percentage even over the figures claimed for the Lowe process. In these experiments, he was desirous of obtaining as true results as he could; and his great object was more from a scientific point of view than anything else. There was not the slightest doubt that the development of illuminating value from oil at the present moment by the Young process was a surprise to him as well as to everyone else. In that process, Mr. Young had obtained from oil by cracking *per se* exactly the same illuminating value as he had been obtaining by fits and starts. Mr. Young's working figures came out at about 1536 candles to the gallon; and therefore, in using these oils, it was manifest that an apparatus which gave, even under able supervision, such figures as 1082 and 1250 candles could not be working the best, whereas when it got down to some 900 candles it showed a very serious loss indeed. The discussion had turned upon so many points that it would take a very long time to even skim lightly over them; and therefore he must content himself with only touching a few. There were several matters besides that of the candle power—one being the cracking surface; and on this point he could answer three or four gentlemen at once. If they were to take paraffin oil, and crack it at a temperature that converted it into gas, it would break up into a mixture of saturated and unsaturated hydrocarbons; and it was possible to get the ethylene by direct decomposition without requiring after-heating. But when they had these hydrocarbons, it was a great mistake to keep them in the presence of a large heating surface for any considerable time, because directly they were formed ethylene split up into acetylene and methane, and the acetylene at once commenced polymerizing up into the higher hydrocarbons of the aromatic series, which were bound to come out afterwards on lowering the temperature, and were therefore lost to the gas. Mr. Hunt had pointed out that Dr. Dvorkovitz had, in the apparatus he had tried at Birmingham, been able to obtain considerable quantities of benzol. The Doctor had recently read a paper on this subject at the Society of Chemical Industry,* in which he said that it was possible to get 30 gallons of benzol from a ton of oil. He (Professor Lewes) ventured to say that the largest part of that 30 gallons of benzol was obtained at the expense of the illuminating power of the gas. His figures were low; and he only obtained 803 candles from a gallon of oil. It was manifest, therefore, that the other 800 or 900 possible candles had gone in making the benzol. He calculated from that, by taking the price of benzol at 1s. 10d. a gallon, that one could obtain gas at a very low price. But did practical gas managers want benzol or illuminating gas? If they were going to take coal, and convert it into oil, as Dr. Dvorkovitz suggested, and were then going to take the oil and crack it up into gas, yielding 803 candles per gallon, and 30 gallons of benzol per ton, how long would the price of benzol keep at 1s. 10d.? It would soon be down to 2d. a gallon, if they went on at that rate; and where would the economy come in? His own impression was that a gas manager would rather convert the oil entirely into gas and coke than into gas having less illuminating power, with a large quantity of residuals which varied in price from day to day. The manager would say: "Give me gas and coke; do not hamper me with a whole lot of other residuals which, if made in large quantities, must invariably bring down their own price." He, therefore, thought it was much better to aim at the entire splitting up of the oil into gas and solids, and leave the residuals out of the question—making as little as possible. The Young process undoubtedly did this. They could take a very heavy oil, and convert it into gas of 1500 or 1600 candles to the gallon, and have 5½ cwt. of coke per ton left behind in the retort—nothing but gas and solid. In the same way, his own process had advantages of the same character; because any oil one could make flow could be injected in this way into incandescent fuel; and, though these crude oils contained an enormous amount of carbon, it was left behind in the fuel, and was burnt up in the next make. There, again, they had practically nothing but the gas and the solid that was left behind and afterwards utilized. Mr. Stevenson had made some inquiries as to the price of enrichment; but, as Mr. Foulis had said, it was of no use talking about it without complete data as to the position of the works and the cost of carriage of materials. If he had been asked the price of enrichment by the Maxim-Clark process, he should have given about the same figure that Mr. Lacey quoted. He should not have thought of carburine at 4½d. a gallon; and therefore he should have utterly misled Mr. Stevenson in that way. Without knowing exactly the cost of all the materials, one could not give the cost of enrichment. He hoped some day to get out a table of the various enrichment processes, with the price per candle at which they could be used at some one spot. Then if they took the percentage of one over the other, this might hold good, although the absolute price would not. One point was raised by Mr. Goulden with regard to the sulphur. No doubt he was correct in saying he should get a small quantity more sulphur in gas made by his process; but the amount was very small, for this reason: The coke contained all the residue of the sulphur the manager could possibly contrive to leave in it, and this residue, when it was heated up by a blast, began to come out; but during the blast period, if it was anything approaching a dry blast, the amount which escaped as sulphuretted hydrogen was very small indeed. It was during the steam blast that the sulphur came out in that form. Some of this was undoubtedly caught by the iron, and fixed as sulphide of iron, although not entirely, because at that temperature there were considerable alterations in the rates of combination. But the excess would be extremely small; and it would be there as sulphuretted hydrogen, not as sulphur compounds, and could be taken out in the oxide of iron purifiers. Mr. Lacey had pointed out, with

* See *ante*, p. 882.

his usual ability, the troubles which beset one in taking the illuminating value of various gases; but he would be pretty safe in dealing with 30-candle gas. It was when thay came to 50, 60, or 80 candles that they got into trouble, because they had then to so reduce the size of the burners that they had only a very small flame, upon which the cooling influence of the burner acted very seriously. What Mr. Foulis had said about enrichment with oil gas was well worth attention. There was not the least doubt, if they wished to enrich coal gas under certain conditions, oil gas pure and simple would be the best thing; but, in approaching this subject, whether it was better to use gas having a large volume and a given illuminating power —say, 20 to 25 candles—or an enormously rich oil gas, would depend entirely on the locality. If they could make their coal gas very cheaply, and then enrich it with oil gas, no doubt the oil gas was the best method. But taking the case of a gas manager who had small, cramped works, who was making 15-candle gas, and wanted to send out gas of 17-candle power, and who could not afford the space necessary for the oil-gas enrichment, then it was that such a water-gas process as Lowe's or his own would prove itself to be of value, because there they had the power of turning out large volumes of gas very quickly, and so increasing the output, and at the same time increasing the illuminating value. Enrichment pure and simple had been spoken of several times. They were told by Mr. Goulden that the plant at Beckton was capable of making 5 million cubic feet of gas per day. This was a big "enrichment." When they reached this quantity, it might almost be called production. He would only refer to one other point, and that was the one raised as to the permanence of the Young gas. He had analyzed the gas, and had seen the process from end to end; and the chief thing about it was that the washing with the oil during production undoubtedly left it in a most permanent condition. There were very few unsaturated hydrocarbons higher than ethylene. All the unsaturated hydrocarbons were absolutely free from anything that could condense; and at the same time among the saturated ones there was nothing much higher than ethane in the gas itself, which again would not condense. He had not the least doubt that, if compressed as in the case of the Pintsch process, it would lose much less illuminating value than the gas made by the Pintsch or any of the oil-gas retort processes, which must of necessity, from the method of manufacture, contain certain of the aromatic hydrocarbons.

The London County Council and the Crystal Palace District Gas Bill.—In our comments on the Inaugural Address of Mr. John Methven at the recent meeting of the Institution of Gas Engineers, we remarked, in reference to his allusion to the Crystal Palace District Gas Bill, that the measure was not yet "out of danger." The Bill, as amended, is now before the Public Control Committee of the London County Council, who have authority to present a petition against it in the Lower House, where it has already been read the first time, if they consider this step to be necessary.

Discovery of Deep-Seated Water under the London Basin.—We learn that water has at last been found in the lower greensand under the London basin, in an Artesian well, 1243 feet deep, bored by Messrs. Le Grand and Sutcliff, at New Lodge, Windsor Forest. All previous deep borings, in search of this source of supply have failed, by reason of older rocks having risen and stopped the continuity of the formations, which usually follow in regular sequence under the chalk. In the present case, after passing through 214 feet of tertiaries and 725 feet of chalk, followed by 31 feet of upper greensand and 264 feet of gault, the lower greensand was reached at 1234 feet; and on penetrating 9 feet into it, water of excellent quality was struck, which, though the site is 203 feet above the sea-level, has risen to more than 7 feet higher than the surface.

The Purchase of the Stourbridge Gas-Works by the Town Commissioners.—Arbitration proceedings have lately been conducted, at the Westminster Palace Hotel, in connection with the proposed acquisition of the Stourbridge Gas-Works by the Town Commissioners. The Arbitrator for the Company was Mr. Thomas Newbigging, and for the Commissioners, Mr. George Livesey—Mr. Shiress Will, Q.C., M.P., being the Umpire. We are unable to state the nature of the evidence, as the arbitration was private. It is rumoured that the Gas Company are asking 35 years' purchase; while the Committee who have the negotiations in hand on behalf of the Commissioners are of opinion that 25 years' purchase would be a fair figure. The purchase price would, we believe, be calculated on the basis of £3450, as representing the profits per annum, *plus* the loan capital.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 959.)

THE opening of the week just concluded was accompanied by all the gloom which marked the close of the week before; and when, in the course of one day, three more Australian banks suspended, and more members declared their inability to meet their engagements, the depression became extreme. Further difficulties confessed, and all sorts of rumours of other difficulties imminent, and extending beyond the limits hitherto localized, precipitated prices down to almost unreasonably low figures. By Wednesday, things were at their worst; and from that point they began to mend. Influenced by more reassuring news from Australia regarding the banking position, a decided reaction set in on Thursday; and every market participated in it to a greater or less degree. The tide was scarcely maintained at full flood till the end of the week; but this was in a degree owing to a gradual closing down of business in view of the Whitsuntide holiday. Still, there was a general feeling that the worst had been got over (and this was justifiable, seeing that only three Australian banks were left standing); and, with the ruthless clearing out of weak operators, things might reasonably be expected to revert to normal lines. The Bank-rate was put up on Thursday to 4 per cent. It is eighteen months since we had so high a rate; but it will probably not last long. The Gas Market has been quiet during this agitating period; and, considering the drift of the times, it is satisfactory to see but little shrinkage in values. Gaslight "A" dropped 1½; but it finished off with a better tendency. The other Metropolitan Companies underwent no change. Suburbans and Provincials were equally unaffected; and business in them was of the quietest. In Continentals, Imperial suffered a fall; but it showed a disposition at the close to improve. None of the rest exhibited any particular feature. Water Companies were extremely quiet; and the only move was a drop in East London.

The daily operations were: The Gas Market was rather quiet on the opening day; and, in sympathy with the general lowering of prices of even the choicest securities, the figures realized showed a falling off. Gaslight "A" receded 1½; and Imperial Continental, 2. Other issues, however, kept well up to the mark. Tuesday's transactions were still more restricted (hardly anything being touched but Gaslight); but values underwent no variation. Business on Wednesday was at about the same level; and prices were disposed to go easier, though quotations still remained undisturbed. On Thursday, transactions were mostly in the heavier stocks; but they were very limited as before. Gaslight "A" was inclined to pick up a little; but Imperial Continental, which had been showing symptoms of weakness, had a fall of 2½. Business was more active on Friday. Prices generally were disposed to be more firm; but quotations did not vary. In Water, East London was quoted 2 lower, without business done.

ELECTRIC LIGHTING MEMORANDA.

Compulsory Liquidation of Woodhouse and Rawson United, Limited—The Fortunes of the London Electric Supply Corporation—Bonuses for Coal Saving and Profit Sharing as Applied to Electric Lighting Undertakings.

ON Wednesday last, Mr. Justice Vaughan Williams made an order for the compulsory winding-up of Woodhouse and Rawson United, Limited, on four petitions. The object of the petitioners is to have a thorough official examination into the past management of the Company, and to make, if possible, the Directors responsible for a large sum, stated to be £80,000, of the lost capital. The concern is already in course of voluntary liquidation; and a Receiver has been appointed in a debenture-holders' action. Having heard the statement of the Liquidator, the Judge remarked that he was not satisfied that there would not be a surplus to be divided among the unsecured creditors, which will be unexpected good news to them. It appears from the evidence of the Receiver that the assets will only realize a certain amount; and it transpires from the observations of the Judge that the hope of the unsecured creditors getting anything out of the wreck largely depends upon the question as to whether the Directors can be made answerable for the heavy claims against them. In these circumstances, it would be rash to conclude that the creditors' prospect of obtaining a dividend is unclouded. The official winding-up will take a good deal out of the general assets; but it will be much more effectual in bringing the management to book than an outside liquidator. On the same day that sounded the knell of the Woodhouse and Rawson speculation, an order was also made continuing the voluntary winding-up of the Electrical Supplies and Fittings Company under the supervision of the Court.

The sixth ordinary general meeting of that particularly interesting venture, the London Electric Supply Corporation, has been held under the presidency of Mr. J. S. Forbes, the Chairman, who had to put the best possible face upon the discouraging fact that the year's work has resulted in a deficit of just upon £4000. There is no professional company-man in London better at this sort of work than Mr. Forbes, who has

on a previous occasion humorously confessed to a feeling of strangeness and embarrassment when called upon to advise the payment of a dividend. There is not much likelihood of his finding himself in this position with regard to the Deptford concern, at any period which he, as a practical man, would be prepared to contemplate. All that he was concerned to do, in moving the adoption of the report, was to show that the Company are emerging, if slowly, from a position of great difficulty. The misfortunes of the concern were ascribed to the want of knowledge, "which was pretty universal," as to the electrical possibilities of the undertaking. Moreover, the disasters of the Company upon one or two occasions completely paralysed the business. The fire at the Grosvenor works occurred in November, 1890, when there were 38,272 lamps connected with the Company's system, which number immediately dropped to 900. The business had, in fact, to be started all over again; but by May, 1891, it had recovered to the extent of 23,000 lamps. Other interruptions occurred afterwards, shaking the public confidence. The undertaking has now, however, crept up to 56,900 lamps; and if the progress of the next two years is only maintained after the same rate, the Company will not be doing so badly after all. Mr. Forbes complained of the competition that exists among the Metropolitan electric lighting companies, which has brought down the standard charge per unit to 6d.—a price regarded by him as inadequate. But the truth of the matter is that, whatever the price per unit, the London Electric Supply Corporation would have found themselves sadly in the rear as compared with their rivals who have had no such initial troubles to overcome. They began too ambitiously, came to grief, and are now painfully picking up the stray bits of custom that the others have left behind; so that instead of being able to find adequate work for those grand 10,000-horse power sets of machinery still lying in fragments at Deptford, the Directors have actually had to spend fresh capital in starting a new 300-horse power unit, which is less than one-half the size of the smallest section of plant with which they began somewhere about four years ago.

It is stated in a recent number of the *Electrical Review* that the Westminster Electric Lighting Company, with a view to the reduction of working expenses, have adopted a kind of bonus system for the encouragement of their engine-room artificers in economizing coal and stores. The engine-room expenses are rated at £4 13s. per 1000 units generated; and the Company offer their men a bonus of 10 per cent. of the difference between this standard figure and the actual cost of the production of the same quantity of electrical energy. No information is given as to how this allowance is expected to work out; but our contemporary pronounces the principle to be "capable of considerable extension in the domain of the electrical industry"—which is probably quite true. Reference is made, in connection with this matter, to the profit-sharing experiment of the South Metropolitan Gas Company, which is described as "similar" to this Westminster bonus on coal-saving, and as having been so successful that "many other large gas concerns have tentatively" followed Mr. Livesey's lead, "on the whole with advantage." We must say that the two last statements are news to us, as they probably will be to Mr. Livesey. We have had the impression that the South Metropolitan experiment, however satisfactory in its general results, remains unique. It is necessary also to point out the difference between profit-sharing, properly so called, and the simple device of a bonus on economical coal-burning. The latter is one of the commonest aids to good management practised by large steam users; while offering the working staff of an industrial concern a share of the general profits is a proposition of a wholly different kind—depending upon a distinct order of ideas in regard to works administration. There is no reason why electric lighting concerns should not go in for profit-sharing, if they choose; and since it must be allowed that their profits are not too unwieldy as yet, they have a capital opportunity of making a start in this line without arousing the jealousy of any greedy shareholders. Our contemporary admits that "the absurdly remunerative prospects which electricity supply as a business possessed in the hands of financial and company men rapidly disappeared on the advent of the engineer." This has not been the fault of the latter, but merely his misfortune. If profit-sharing is competent to help in creating the fund that it aims at dividing, all electric lighting companies ought to welcome it.

Death of Mr. W. Richards.—In the person of Mr. William Richards, who died at Herne Hill, on Friday, the 12th inst., there passed away one of the few of the older generation of gas engineers whose names are well known to their successors. Mr. Richards will be generally remembered as a prolific writer upon gas manufacture. He contributed papers to the British Association of Gas Managers, as well as to various technical periodicals; he edited the book of Samuel Hughes on "Gas-works," and published a Treatise of his own on the gas industry. His best claim to fame, however, rests on the part he took in the invention and development of the dry gas-meter, from which unfortunately he did not derive any very substantial benefit. Mr. Richards had been failing in health for some years; and his death was due to disease of the heart.

THE NEW GOVERNMENT PERIODICAL.

The announcement by the President of the Board of Trade of the intention to publish a *Labour Gazette* was recently noticed and commented upon in these columns; and now that the intention has been carried out, and the first number of the new Government journal has appeared, it is desirable that our comment on the subject should be completed by a critical notice of this publication, which is actually on sale for one penny. It is to appear monthly for the present; but, having regard to the nature of the services it is intended to perform to the industrial community, it is obvious that this is too long an interval, and that, if the journal is to be of any real good to employers and workmen, it must be published weekly. This is what ordinary newspaper publishers and editors would do with it; but it is doubtless difficult to get a Government Department to move quite as quickly as is customary and necessary in the commercial world. It may be admitted, however, that the journal makes a fairly good start, so far as appearance goes. It consists of 24 clearly-printed pages, and contains a large amount of useful information of the kind the so-called Labour newspapers ought to give to their readers, but do not. From the introductory article, setting forth the objects of the *Labour Gazette*, it is to be gathered that this is to be "a journal for the use of workmen, and of all others interested in obtaining prompt and accurate information on matters specially affecting Labour." This statement does not read well in the light of a monthly issue, and justifies us in taking our first point against the publishing arrangements at present in force.

The next statement of the introduction is that the *Labour Gazette* will not be concerned with mere questions of opinion. "The aim of the Department in the publication is to provide a sound basis for the formation of opinions, and not to supply opinions." This is quite right and proper in the circumstances. It is remarked that, in working towards this object, there will be three classes of materials dealt with. First, there is the information bearing upon labour which is already collected and published periodically by various Government Departments, but which is not readily accessible by the working classes, either because it is buried in large and expensive publications, or because workmen have no means of learning when and how to obtain it. There is again much useful information of the same character published by Foreign Governments, which is "inaccesible *to* British workmen" as the official Editor has it, for the same reasons, with the additional barrier of being in an unfamiliar language. It is intended to collect and sift this information, and to publish part of it monthly; adding references to the remainder. Secondly, there is a great deal of information that would be useful to employers and workmen which is already obtained through various official channels, but which has hitherto not been published at all, or has only been issued after the period of its usefulness has passed away. As examples of such information in the present number, mention is made of a list of Trade Unions, and of Co-operative and Friendly Societies registered and dissolved during the month; also returns of pauperism in the chief industrial districts of the United Kingdom, of prosecutions under the Factory and Workshop Acts, and of accidents to workmen in the course of their employment.

In the third category of information are included "many matters of importance on which exact information has not hitherto been obtained, or at least has not been officially collected." It is here that the opponents of the way in which the Board of Trade have made the arrangements for conducting the *Labour Gazette* will find their first concrete grievance; for this category embraces the reports of the Local Correspondents of the Department, "connected for the most part with important trade organizations." That is to say, the publication will serve as the mouthpiece of a number of Trade Union officials, who, as *The Times* critique aptly puts it, "by virtue of their position, naturally regard matters not only from a workman's, but from a trade unionist's point of view." We can also endorse the criticism that "there seems to be little count taken all through the publication of those masses of non-Unionist labour, which, as events connected with the Hull strike have just shown, are so large in the country, and so capable of exercising a weighty influence in the relations between employers and employed." In other words, the *Labour Gazette* has been put into the hands of the minority of workers, as is shown in the opening sentence of the "general summary" of the "State of Employment in April." It says: "Returns of unemployed members at the close of April have been received from 23 Trade Unions, with a total membership of 296,771, of which number 20,478, or 6·9 per cent., are reported as being out of work, as against 25,622, or 8·7 per cent., in the previous month." But this number of 296,771 represents only a very small proportion of the total of the working population of the country, while it ignores everybody who is not a trade unionist. No safe conclusions can be drawn from such figures, because if the disturbance at Hull furnishes a quota to the return, this one dispute, elsewhere asserted to "affect 10,000 men," would be sufficient to account for nearly one-half of the total number of men returned as unemployed.

It may be a reasonable idea to take the figures contributed by trade societies in regard to the employment of their members as indicative *pro tanto* of the condition of the trades with which they are connected; but this can only be when the restricted meaning of the data is rigidly kept in the forefront of the record, and computations of percentages, &c., based upon them are limited to very simple issues. Even so, such calculations only apply to the followers of skilled trades, and cannot be extended to the shifting population of unskilled labourers, whose membership of unions is commonly intangible. In its present form, the *Labour Gazette* completely fails to grasp the problem presented by the majority of unorganized labour, which in reality fixes the conditions of employment. The incompleteness of its local reports is counteracted, as well as emphasized, by the circumstance that these are given under the names of the contributors, so that those who are interested in the subjects dealt with are able to discount the information given according to their knowledge of the competence and impartiality of the reporter. This is, however, anything but satisfactory. It cannot be possible to present a true picture of the condition of employment in any locality by taking for gospel the statements of a Branch Secretary of a Trade Union, who may be directly interested in spreading the report that trade is bad in the place, merely for the sake of keeping workmen away while a local strike is being adjusted. If any such abuse of the *Labour Gazette* should occur, one can easily foresee a future of endless complaints of misrepresentation by employers, or of the publication being treated by the latter with contempt—neither result being creditable to the Department. It seems to us that it would have been very elementary statesmanship to have avoided the suggestion of this partiality in local reporting by arranging for returns by independent parties. We venture to offer this prophecy respecting the local labour reports in the *Gazette*—the only places where trade will be reported as good will be places where advances of wages have been demanded and obtained. All sorts of conditions, from strikes against free labour upwards, will be covered by the phrase "bad trade," the import of which will be incomprehensible unless the point of view is carefully borne in mind.

The *Gazette* contains much particular information concerning the trade disputes of the past month; but in a tabular statement professing to give an account of all troubles of the kind which began in April, the remark, "No details of settlement," occurs with irritating frequency. It is pretty clear, however, that, where the men won, it was generally because the strike was on some economical point, and affected some particularly strong organization of skilled workers, or "tradesmen," as they are very properly called. It will be interesting to see what the next number has to say about the Hull strike, mentioned in this issue as "still pending." There is a short article on the strike, which is characterized as "the most important dispute of the month;" but this is very carefully worded so as not to offend unionist sympathies. It nevertheless contains some curious expressions. It has apparently been found impossible to deny that the attempt of the Dockers' Union officials to collect the arrears of members' subscriptions was one of the causes that precipitated the trouble; but this point is smoothed over by the pretence, given on the authority of these same officials, that it was not a demand of the Union, but "had been acquiesced in without objection by some of the largest firms." How anything that has not been demanded by one party or person can be said to be "acquiesced in" by another, remains to be explained. But the word is a good one for dockers, who cannot be suspected of pedantry in regard to style; and their artlessness in this respect is paralleled by the official scribes, who are certainly not authorities in the matter of writing English.

Under the heading "Labour Cases for April" a summary is given of the more important instances of litigation during the month under the various statutes specially affecting labour of which the Department has received information. Prominence is given here to the case of *Temperton v. Russell*, which was the action taken by a Hull builder against a number of Trade Union officials for inducing various firms to break their contracts with the plaintiff, and leading the workmen in the employ of these firms to refuse to do work for his benefit, and to leave their employment if their employers fulfilled their contracts with him. It has been happily impossible to minimize or explain away the verdict of £250 damages accorded to the plaintiff, which has been sustained on appeal. If the decision of the Courts had happened to go the other way, the consequences thereof might be as disastrous as those that have attended the famous, or infamous, "picketing" judgments.

A useful feature of the *Labour Gazette*, if properly worked, will be the table of retail prices of food sold by certain co-operative societies. More details are wanted, however; for many of the commodities listed are described in too general terms, which exclude all sense of quality in the goods. On the whole, we are disposed to welcome the publication as not at all a bad one, so far as it goes. We shall obtain a copy regularly, for office use; and we recommend our readers to do the same. It may, and probably will, be improved; and it will do some good, if only in causing the disappearance of a few of the speculative Labour newspapers, which, while professing to help the workman, are only tools in the hands of agitators, charlatans, and faddists, when they are nothing worse.

MR. S. R. OGDEN.

We regret to record the death of Mr. S. R. Ogden, Engineer to the Blackburn Corporation, which took place on Monday last week, at his residence in Blackburn, aged 58. Mr. Ogden's first appointment was to the management of the Kippax Gas Company, near Leeds. He next became Manager of the Goole Gas Company; and subsequently (in 1869) Superintendent of the Wortley station of the Leeds Gas Company. On Nov. 1, 1875, he was appointed Engineer to the Blackburn Gas Company, whose undertaking was transferred to the Corporation in 1878. During the eighteen years he held this position, he partially remodelled the No. 1, and entirely reconstructed the No. 2 station, where the make of gas is about 3 millions per diem. These works testify to the constructive ability possessed by Mr. Ogden; and everyone who has seen the works expresses surprise at the perfect way in which they have been kept after so many years' working. This has been brought about by the late Engineer personally attending to matters of the smallest detail, and keeping everything in thorough repair. Mr. Ogden received a thoroughly practical training in connection with gas engineering under his father, who was a maker of gas apparatus at the Isle of Cinder, near Leeds; and Mr. Ogden, when young, superintended the erection of plant in England, Sweden, and elsewhere. Mr. Ogden had not been in good health for some time before his death; but he was removed rather suddenly at last. The funeral, which took place last Friday, was of a public character—the members of the Corporation, the officials, police, and workmen attending; also a large number of Freemasons in their regalia, and many personal friends. The public buildings were closed; and most of the principal shopkeepers testified their respect for the deceased as a good public servant. Several gas engineers were present. Mr. John West, of Manchester, was requested by the Council to represent the Incorporated Gas Institute, of which Mr. Ogden was a Member of the Council. He was accompanied by Mr. C. Armitage, of Lancaster; Mr. W. W. Hutchinson, of Barnsley; Mr. W. Duff, of Morecambe; Mr. T. Duxbury, of Darwen; Mr. W. Miles, of Clitheroe; Mr. G. H. Niven, of Cleckheaton; Mr. John Niven, of Clayton; and several others.

NOTES.

The Mechanical Equivalent of Heat.

Mr. R. T. Glazebrook has contributed to the Royal Society an abstract of a paper by Messrs. Griffiths and Clark on the value of the mechanical unit of heat, as deduced from some experiments performed with the view of establishing the relation between the electrical and mechanical units, together with an investigation into the capacity for heat of water at different temperatures. The investigation appears to have been of a most difficult and abstruse character. The authors say that, if a calorimeter is suspended in a chamber, the walls of which are maintained at a constant temperature, it is possible, by observations over a small range across this outside temperature, to deduce the rate of rise due to the mechanical work done in the calorimeter, when the supply of heat is derived from stirring only. By repeating the observations in a similar manner over ranges whose mean temperature differs from that of the surrounding walls, there is obtained the change in temperature due to the combined effects of the stirring, radiation, conduction, and convection at all points of the range of temperature selected. The calorimeter was suspended within an air-tight steel chamber having double walls; the intervening space being filled with mercury. The whole structure was placed in a tank containing about 20 gallons of water. The heating of this was effected by gas burning at a large number of jets underneath a flat silver tube, through which water was continually flowing into the tank. The consumption of gas was governed by a regulator only, described as being of a "novel form." As the result of the investigation, it is stated that the unit of heat, or "joule," was found to be equal to 778·99 foot-pounds in the latitude of Greenwich. In the centigrade system, the unit would be equal to 1402·2 foot-pounds per degree.

The Most Costly Light Known.

Perhaps the most costly artificial light ever produced as an incident of scientific research, is that of the diamond burning in oxygen, as exhibited by M. Moissan in the course of his investigations into the different peculiarities of the diamondiferous forms of carbon. The action of oxygen upon the diamond has long been known; but hitherto no precise data concerning the temperature of combustion has been obtained. In order to ascertain the missing information, M. Moissan has employed a modification of the Le Chatelier pyrometer, placed along with the diamond in a wide porcelain tube closed at the end by glass plates through which the combustion in oxygen could be observed. It was first found in this way that, when the temperature is slowly raised under these conditions, the combustion of the diamond proceeds slowly, without the production of light. But if the temperature is raised to 40° or 50° above the point at which this slow combustion commences, a sudden incandescence occurs, and the diamond appears surrounded by a brilliant flame. Various deeply-coloured specimens of diamonds burnt

with production of incandescence and flame at temperatures of from 690° to 720° C.; but transparent Brazilian diamonds did not attain the stage of slow combustion without incandescence until the temperature of 760° to 770° C. was reached. Specimens of exceedingly hard bort commenced to combine with oxygen at 790° C., and burnt brilliantly at from 840° to 875° C. When Cape diamonds were heated to a temperature of 1200° C. in a current of hydrogen, they remained unchanged; but if the stones had previously been cut, they frequently lost their brilliancy and transparency. It is a curious fact that metallic iron at its melting-point combines with the diamond in a most energetic manner, and crystals of graphite are deposited in the mixture as it cools. Hence the experiment forms a striking mode of converting the allotropic form of carbon, which crystallizes in the cubic system, into that which crystallizes in the hexagonal system. Unfortunately for M. Moissan, it is not yet possible to reverse the operation.

Tar and Asphalte Tank Renderings.

A mixture of coal tar and Californian rock asphaltum has been successfully employed by Mr. R. C. Gemmell for lining a reservoir for the city water-works of La Grande, Oregon. The reservoir is of oval shape, part in excavation in heavy clayey soil, and part in embankment made from the excavated material, with inner slopes of 3 to 1. The depth of water is 10 feet; the area of surface, 20,880 square feet; and the capacity, 1,000,000 gallons. The lining consists of one layer of brick on edge, covered by ⅜ inch of the bitumen mixture. After the earth had been excavated and the embankment made, the whole surface was thoroughly rammed with iron punners weighing 25 lbs. each. The bricks were then laid, and rammed solidly into place; the joints and cracks being brushed full of clean sand. Coal tar was used as a flux for the asphalte, in the proportion of from 10 to 12 per cent. by weight of the latter; the mixture being "cooked" by boiling for five or six hours with constant stirring. A large bucketful at a time was taken out of the kettle by two men, and spread in a thin layer over the bricks by means of shovel and broom. It required two layers put on in this way to make the requisite thickness of ⅜ inch. As much sand as would adhere to it was sprinkled over the last layer while hot. The reservoir has never leaked. It is suggested that this way of rendering tanks water-tight at small expense might be extensively used for sewage works, &c.

COMMUNICATED ARTICLE.

THE CAPITAL INVESTED IN GAS UNDERTAKINGS, AND THE CONSUMERS OF GAS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The amount of capital invested in the undertaking that supplies the neighbourhood with gas, is not a matter of general interest to the gas consumer. The subject is not likely to occur to his mind unless something happens to direct his attention to it—such as a suggested purchase by the town authorities, or an application to Parliament for further powers. In that event, his interest is of an evanescent character, as in any other passing event; and he rarely realizes that there is an intimate connection between the capital expended, and the price per 1000 cubic feet that he is called upon to pay for gas at the end of each quarter. Yet it is a fact that the gas revenues have to bear a definite charge in the shape of standard dividends upon the nominal paid-up capital of the company. This standard dividend, as averaged over the whole capital—share, debenture, and premium or non-dividend bearing—is not 12, or even 10 per cent., as many of the public (including some who are in a position to be accurately informed) would have us believe. It usually figures out to within a fraction of 6 per cent., and is rarely more than 8 per cent. Further, since the introduction of the auction clauses, whereby all new capital issued is sold by auction to the highest bidder, and the premium realized passes into the capital account of the company, the average rate has been gradually falling; and also there has been a tendency to equalization as comparing one undertaking with another.

Other causes have also been at work. The old order of 10 per cent. dividends, new capital issued *pro rata*, and practically no competition—or, in other words, no necessity for reducing the price of gas—has passed away. Now we have sliding scales and auction clauses; a very real competitor in cheap oil; and a more largely vaunted one in electricity. The pretensions of the latter will always find acceptance as fact in certain quarters. And there is a certain feeling of unrest, as not knowing what science may bring forth. This is only a vague sort of sentiment. But nevertheless its operations are as evident, as those founded upon established facts; and it has even invaded the precincts of the gas-works board-room. So that in place of the tendency to increase capital as fast as it was wanted (and occasionally a little faster), we find there is now every inducement to keep capital down. Fresh issues of capital are not made before they are wanted; and they are considerably less in proportion to the whole, than the increase of business which necessitates them.

A great deal of trouble and expense have been incurred, for many years past, in the preparation of the annual parliamentary returns relating to gas undertakings. They are of value as works of reference, to parties interested; and they usually come into evidence when questions of valuation are concerned. It would be interesting, however, to know how many copies of them are purchased in a year, and especially by persons not directly interested in gas undertakings. This in passing. With a word of appreciation as to the generosity of the Government, in providing these statistics, which come in excellently for the present purpose, I would proceed to notice the fact that they afford interesting information on the question of capital and its relation to the consumer of gas. Given a fair average rate of dividend—say, 6 per cent.—the amount of capital as compared with each 1000 cubic feet of gas sold per annum, has a direct bearing upon the charge to the consumer. If the capital stands at 10s. per 1000 cubic feet sold, a tax or loading of 6 per cent. on that sum—viz., 7·2d—is sufficient to provide the dividend; and accordingly, the working expenses, repairs, &c. (or, in other words, the net cost of the gas, *plus* 7·2d.), represents the sum for which gas can be sold by the particular undertaking. But if, instead of standing at 10s., the capital stands at 30s. per 1000 cubic feet, the loading must be increased to 1s. 9·6d. in order to pay the dividend. Given the same actual net cost of making and distributing the gas, the consumer must pay 1s. 2½d. more in the second case than in the first. Or, taking the net cost at 2s., the charge to the consumer will be practically, 2s. 8d. in the first case, and 3s. 10d. in the second. Perhaps it should be mentioned here that this is no fictitious case, exaggerated for the purpose of illustrating the argument. An examination of the parliamentary returns will show that there are companies labouring under the disadvantage of a capital account running as high as 30s. per 1000 cubic feet of gas sold per annum. These examples are sufficient to show that the expenditure of capital has a very real interest to the consumer, and further, that since the auction clauses have tended to reduce the actual *average* rate of dividend paid on the capital invested, the actual capital concerned is of much more importance than the nominal rates of dividend paid.

The circumstances under which the expenditure of capital is incurred vary so greatly in different districts, that it is impossible to lay down any very definite rule about the expenditure as compared with the production. The actual cost of the retorts, purifiers, gasholders, and buildings is comparatively simple; but the matter is complicated by the cost of land, legal and other charges, payments for goodwill in buying up existing undertakings, and a widely varying extent of mains, services, and meters—apart from the question of carved or moulded stonework, fancy castings, ornamental painting, and mosaic tiles, as compared with plain bricks and iron. Some believe in substantiality, space, and elegance; and others, in the very cheapest arrangement that will do for the requirements. Then there is always a considerable margin of reserve capacity; and the extent to which this has been provided may be perfectly wise and judicious, or it may be quite the reverse. Yet after allowing for these and other considerations, one is scarcely prepared for the fact that the ratio of expenditure per 1000 cubic feet of gas sold is as great as about one to five. The lowest proportion, in a selected list of about fifty undertakings taken from the returns for 1891 for undertakings other than those owned by local authorities, is about 7s., and the highest about 35s. If we come to figure out the cost of a large gasholder, or a large retort-house, at per 1000 cubic feet capability, the result comes out less than a smaller one. The same as regards distribution, or office accommodation. Yet there are several provincial undertakings having a production of only 100 to 150 million cubic feet per annum, with a smaller capital account than obtains in London or our principal towns. Nor does locality appear to have any effect. The large and small capitals are fairly shuffled and distributed throughout the whole country.

The returns show most unmistakably that heavy capitals are a thing of the past. With the increase in consumption, and the addition of capital including an important proportion of premium or non-dividend-bearing stock, and with improvements in apparatus of all kinds, there has been a very steady fall, year by year, in the proportion of capital per 1000 cubic feet of gas sold. This fall has been larger in the case of concerns that were loaded with heavy capitals at the first. Taking the year 1880, when the parliamentary returns were commenced, the lowest is about 13s., and the highest something over £2. During the twelve years there has been a great advance in the demand for gas. In some districts the increase has been double or even threefold; leading to a suspicion that new districts have been taken on, or that the business was in other ways imperfectly developed at or previous to 1880. But leaving out accretions due to new business, the normal rate of increase during that period is not less than 50 per cent. This is an instructive commentary, by the way, for those who, at about the beginning of the period under consideration, talked confidently about gas having reached its zenith, having passed it, and having started towards extinction.

With these reductions both in regard to proportion of capital invested, and to the average rate of dividend paid, the advantage offered by the transfer of the undertaking to the local authority grows less and less. The latter body have no power to alter the actual net cost of the gas. At best, they can only promise the saving of the directors' fees, and a little reduction

in establishment expenses, the whole of which does not amount to over a penny or so per 1000 cubic feet. It is questionable whether these advantages (such as they are) are not attended with counterbalancing drawbacks. But the main feature of the economy is to be looked for in the item of charges for dividend or interest. With an average dividend of 10 per cent. all round, there is some margin for saving. The corporation may be able to negotiate such terms as will enable them to work with a less sum in the form of interest on the loans acquired for the purchase, than that represented by the dividends paid by the company. But when the average dividend is brought down to 6 per cent., the company could not be compelled to sell at terms that would leave any prospect of such a reduction. Of course, this is speaking from the gas consumers' point of view only. There is the ratepayers' aspect of the question, which in most cases is the dominant one—governing not only the circumstances of the purchase, but also the subsequent administration of the undertaking.

TECHNICAL RECORD.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

The Annual Meeting at Columbus.

(*Continued from p.* 827.)

Mr. G. A. Allen, of Zanesville, read a paper on "Discrimination by Gas Companies in the Treatment of their Consumers," in which he advocated the application of the usual customs in selling goods to the sale of gas. Any attempt to follow an unusual course—such, for instance, as having only one price for gas to all classes of consumers—aroused resentment rather than otherwise; for it was known that such conditions were only practicable in the absence of competition, and the company were therefore suspected of presuming on their monopoly. If it was right to discriminate between customers, the public would support them in doing so, provided proper tact and judgment were used in explaining and convincing people of the fact. He not only advocated lower rates to large consumers, on account of the saving in relative cost of service and meter, collecting, and clerical work, but also the "extra bargain for this day only" style of selling. In introducing gas-stoves, for example, a liberal concession on all fixed within a specified time, would induce a large accession of business. It was impossible to please everybody; but, by judicious discrimination within fair and just limits, a largely increased use of gas could be attained.

Mr. Butterworth opened the discussion. He said at Columbus, they tried to get back customers who had taken the electric light, by privately offering to supply Lungren lamps free of charge. They secured several in this way; but the thing became known, and the regular customers, who paid 1s. per month rental, complained that, if anyone had a reduction, it should be those who had stood by the Gas Company. The practice had therefore to be stopped. Then he got into hot water by piping houses at less than cost, in cases where the custom could not be secured otherwise. He mentioned these things, as showing that it was possible to discriminate in other ways besides the price of gas, and also as illustrating the importance of keeping to regular and fixed rules in dealing with the customers. In some towns, a sliding scale of prices was used, according to the quantity of gas consumed. Mr. Allen agreed with the tone of the paper; and he mentioned that his Company had bought a number of Lungren lamps, and fixed them for certain customers gratis. But he did not intend to buy more, and felt under no obligation to supply other customers on the same terms. His object, of course, was to introduce the lamps. He knew of a law case, in which it was decided that a water company could fix one rate for the large and another for the small customer; and he presumed that would apply equally to gas. Mr. Starr pointed out that, in several ways, the purchase of gas was different from the purchase of goods at a store. He advocated a good article at a moderate price, and civility and a disposition to oblige in dealing with customers. A little price and a big burner, would give more satisfaction than a big price and a small burner; and that was the key to the situation. When he reduced the price of gas, he told the people he could not afford to maintain the reduction if they did not use larger burners. Take care to treat the customers as if you valued their custom, was his advice. He supplied gas at one price, with the exception of 20 per cent. discount for gas-engines; and as to stoves, the introduction of natural gas had taken away that branch of his trade. Mr. Clapp said he could not run his business successfully without scaling the prices according to quantity consumed; but he did not regard that as discrimination. Mr. Coombs thought that it was discrimination, one way or the other, to sell at one price only. Mr. Gwynn had three different prices according to consumption, and also a discount for prompt payment at the office. This plan worked satisfactorily, and without even a single complaint. He gave the service and fixed the meter gratis in all cases; but he did not fit burners or lamps to one customer and not to another. One of his rules was to regard each meter as a separate customer, and not to allow the adding of bills together, to obtain the advantage of a lower rate. Mr. Hurlbert had found trouble with a sliding scale; and lately adopted a uniform price, with great advantage. Mr. Faben inquired whether the sliding scales previously mentioned were fixed by, or with the consent of, the town councils. When the law said a maximum price, it did not prevent the selling at a lower price. Mr. Gwynn replied that only his highest price was the figure fixed by the Council; but they had never objected to the sliding scale. Mr. Clapp was in the same position as Mr. Gwynn. Mr. Greenough believed in the sliding scale, but not in different rates for purposes other than lighting, except in special cases. The same rules, however, would not apply to all cases.

The subject of "Governor Burners" was dealt with in a paper read by Mr. Butterworth who mentioned that two-thirds of the houses in Ohio were lighted by oil, as showing the necessity for teaching gas consumers how to use gas in the most economical manner. He did not agree with a remark he had heard, to the effect that it paid to maintain a high pressure in the mains; the increased loss by leakage being considered as more than covered by the increased gas bills. The best policy was, not only to cheapen the gas by reducing the price, but also by showing the customers the best ways of using it, in order to obtain a maximum duty per unit of gas consumed. The differences of pressure that must necessarily obtain, not only in various parts of the district, but at any one location, must make a great difference in the value obtained from the gas; and these variations were unavoidable. In the different parts of a district, it varied as much as 20-10ths, or even more. The practical effect of this was shown by an experiment with a No. 5 ordinary burner, which at 10-10ths afforded a duty of 2·2 candles per cubic foot of gas consumed; at 15-10ths, 2·3; at 20-10ths, 2·0; at 25-10ths, 1·6; and at 30-10ths, 1·4 candles. Experiments with a No. 3 burner gave similar results. A consumer of gas at 30-10ths pressure would have to pay 50 per cent. more than one at 15-10ths for a similar amount of light. Applying this to the case of single consumers, he knew of one where the pressure fluctuated more than 10-10ths in the course of an evening. Mr. Fowler had recently mentioned a variation of as much as 29-10ths at one particular point in the mains, It was nonsense to talk about the fluctuations of electric lamps, while such a variation in duty was allowed to obtain in the case of gas. Apart from this, the sight of roaring or smoking gas-burners could not but prejudice gas, as compared with oil or electricity. Having emphasized the necessity for uniform light, maximum efficiency, and perfect combustion, he proceeded to discuss how this could be obtained. The best plan was the introduction of governor burners, though service and district pressure regulators should not be neglected. Check burners and turning back the main-tap were at best but partial remedies; but the difference in duty caused when the pressure varied from 10-10ths to 30-10ths was much less than that above stated, if check burners were used. Several forms of governor-burners were exhibited at this stage; and attention was directed to a table of tests with them, at pressures ranging from 10-10ths to 40-10ths, which showed a variation of less than 3 per cent. Where the pressure was uniformly low, ordinary burners were not specially wasteful; and where it was always high, check burners could be used with advantage; but for all other circumstances, governor-burners were the best. As sold at present, the governor burner was costly, and not always efficient; but a large demand would soon result in a cheap and reliable article being placed on the market.

The President having invited discussion, Mr. Nash spoke of the value of the paper, and lamented that gas-fitters paid so little attention to the question of burners. Mr. M'Donald remarked that bad gas-burners were usually said to be the cause of dirty ceilings; but his impression was that nine out of ten were due to other things. He had seen a blacker ceiling over a steam radiator than ever he saw over a gas-burner. Anything that caused a current of air to impinge upon the ceiling made it become smoky; and this would always obtain in a dirty locality, whatever burner was used. Mr. Starr said governor burners were costly; but for years he had given away "Empire" check burners, which practically secured good and uniform results. Mr. Coombs followed a similar plan; but lately he had adopted Bray's No. 6 "Special," as preferable to the "Empire." He took care to adjust every burner, according to the purpose for which it was required. Mr. Miller thought that the batswing burner gave a much better efficiency than the fishtail. Mr. Shelton said the question of keeping governor burners in good order was an important one. What would be the annual cost for renewal and repair? Mr. Printz preferred Bray's "Special" union-jet for distribution to consumers. Mr. Butterworth said he agreed with Mr. M'Donald, though a bad burner would undoubtedly blacken a ceiling. Bray's low-pressure burners blew at about 25-10ths; but the high-pressure ones would burn steadily at 40-10ths. They did not, however, burn well at low pressures. Mr. Shelton was right as to the repair and maintenance of governor burners. They needed frequent cleaning, but not renewing.

(*To be continued.*)

The Huddersfield Corporation Water Engineer.—The Huddersfield Town Council last week raised the salary of their Water Engineer (Mr. J. W. Schofield) from £200 to £300 a year.

REGISTER OF PATENTS.

Maintaining any Required Temperature in Gas-Heated Greenhouses, Ovens, &c.—Phillips, W., of Fenchurch Street, E.C. No. 8298; May 3, 1892.

To attain the object arrived at in his invention, the patentee provides a syphon-tube, with a closed ball at one end, and partly filled with thermo liquid and mercury, to form a seal. To the open end of the tube is securely fixed a suitable apparatus (made of metal, vulcanite, or other substance), consisting of a cap-tube, having two openings at different levels, at right angles to the hole through the cap-tube. The cap-tube is tapped inside to about half way between the two openings; and the lower part is opened out clear of the threads to receive the syphon-tube, but not to cover the lower hole or outlet. The inlet is in connection with the ordinary gas-mains; the outlet being connected to the Bunsen or other burners at the heating appliance. A hollow steel tube (screwed on the outside) is made to screw into, and through the cap-tube, and project down into the syphon-tube; a hole being drilled in the side of this hollow tube, corresponding with the hole of the inlet in the cap-tube. This hollow tube is closed at one end; and the lower end in the syphon-tube touches the mercury at a given temperature—thus preventing the passage of gas to the main burners. But should the temperature fall, the opening of the hollow tube will be exposed; and there will be a free passage of gas to the burners, which are then lighted by a sentinel or bye-pass light provided for the purpose. The increase of temperature produced by the working of the heating apparatus will then again cause the mercury to rise, and close the opening in the hollow tube, which will again shut out the lights. The apparatus is applicable in rooms, greenhouses, ovens, &c., to the regulation of heating by gas, where the temperature requires to be maintained within a few degrees, and also where it is requisite that the temperature shall not fall below a certain point.

Tapping Water-Mains and Forming Branch Connections therewith under Pressure.—Newton, P. A.; communicated from H. H. Burritt, of Belleville, U.S.A. No. 8365; May 3, 1892.

The object of the present invention is to provide means for tapping water-mains, and forming branch connections therewith, a method of forming branch connections with a main under pressure, and an improved construction of main and connections, by which the necessity of either cutting off the main pressure, or leaving a gate-valve next the main, is avoided.

It is pointed out by the patentee that, in tapping water-mains under pressure, it has hitherto been necessary to use a gate-valve upon the branch-pipe, to close the opening next to the main, until the connecting-pipe is laid; this gate-valve forming a permanent part of the construction. After the connecting-pipe is laid, however, the gate-valve is of no use, as the water system is controlled by other valves; and this waste gate-valve is found to be a constant source of trouble, as it soon becomes leaky. He has therefore designed a method for tapping mains by which all necessity for the gate-valve, or cutting off the pressure in forming branch connections, is avoided, and by which the branch connections, when formed, may be first tested by the admission of pressure from the main, and, in case any loose joint or other defect in construction is found, the main may be plugged and the connections removed, and the joints repacked, or other repairs made, without cutting off the water from the main.

In carrying out the invention, a sectional sleeve is used, formed in two parts as usual, so as to be clamped upon the main; but this sectional sleeve is of peculiar construction, in that it is provided with a hub (formed integral therewith), consisting of a short pipe adapted to support a gate-valve and to co-operate with an improved plug, and a branch opening at an angle to the straight pipe, and with which the branch connection is made.

The tapping-machine consists of a cylinder, flanged at the tap end for connection to the pipe. It carries at its outer end a screw, rigid therewith, and forming a part of the feeding devices for the tap. A bracket also is carried by the cylinder, in which is mounted a driving-shaft, actuated by a crank; the shaft being provided with a worm, which meshes with a gear, through which a rotary movement is transmitted from the shaft to the tapping-spindle. The tapping-spindle is mounted in the cylinder, so as to rotate and slide therein, being packed in the cylinder head, so as to prevent leakage, and is constructed at the feeding end to carry a ring cutter and a drill—the drill being provided preferably with side springs, for withdrawing the piece cut from the main by the cutter. The tapping-spindle slides through the cylinder and driving-gear during the operation of tapping; and to permit this movement, the gear is provided with a slot, and the spindle is splined to the gear so as to rotate therewith, but slide therein by a block, forming a spline, and secured to the spindle by a set screw. In order that the spindle may be adjusted to different lengths beyond the cylinder, it is provided with a series of recesses, in any one of which the spline may be secured in accordance with the length of the spindle desired; the recesses being set at such distances apart that the spline may be changed from one to another within the slot in the driving-gear, continuing the feed during a single operation of the tapping-machine.

The operation of forming the branch connection with the main is as follows: The sectional sleeve is secured upon the main, and tightly packed, so as to prevent all leakage; and the branch pipe is connected with the branch, and the joint packed. The gate-valve is then secured to the straight pipe; and the tapping-machine mounted on the gate-valve. The gate-valve being open, the drill and cutter are run in; and the main is thus drilled. The drill and cutter are then withdrawn, and the gate-valve closed. The pressure in the main now being transferred to the branch connections, the joints in these and between the sectional sleeve and the main are tested. If any leak is found, the tapping-machine is removed, and the screw-plug substituted for the drill; the tapping-machine being then replaced, and the screw-plug run in, to plug the opening cut in the main by the drill. The sectional sleeve may then be removed from the main and repacked, or other joints packed wherever required; and this setting operation can be repeated, if necessary, until perfectly tight joints are obtained. When no leakage is found on testing, the cutter is again run in through the open gate-valve, and a piece cut from the main thereby; this piece being removed with the cutter by springs on the drill, which are forced through the drill opening in the main during the operation of the cutter and spring outside, so as to seize the piece, and withdraw it from the cutter. The cutter having been withdrawn into its chamber, the gate-valve is closed, and the tapping-machine removed.

The plugging-machine is then substituted therefor. It consists of a flanged cylinder, adapted to be secured to the pipe, and in which the plugging-spindle is mounted; this spindle consisting of a plain shaft, provided at opposite ends with angular portions, the outer of which is arranged to receive a wrench outside the cylinder, and the other to enter the angular opening in the cap of the plug, for rotating the latter. The plug is then forced into position by the shaft with the ring upon the shoulder; the rim of the cap being passed inside the lugs by the recesses, and the spindle rotated so as to turn the screw surfaces of the rim upon the lugs, and force the plug hard home, with the ring pressed against the shoulder, so as to form a tight joint. The gate-valve and plugging-machine are then removed, and the plug packed between the cap and the outer end of the pipe, so as to permanently close the latter—the construction thus being completed without a gate-valve between the plug and main.

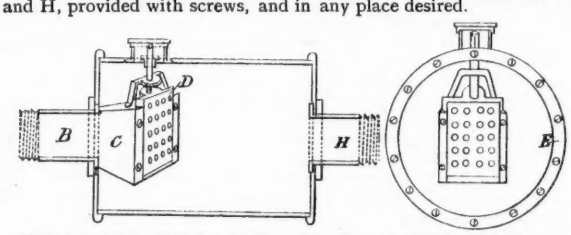
Valve Operating and Governing Mechanism for Gas-Engines.—Hamilton, J. H., of Sandiacre, Derby. No. 10,254; May 30, 1892.

This invention is particularly adapted to engines of small size, working on the "four-stroke cycle" principle.

A rotating-valve controls the admission of gas and air and the exhaust of the products of combustion. It is preferably arranged at the back end of the cylinder, with its axis parallel to that of the crank-shaft; and on one of the ends of the valve which projects through the bearing in which the latter works, a series of ratchet-teeth are arranged. The number of such teeth is a multiple of the number of revolutions corresponding to a cycle—that is to say, in the engine described, the number would be even, and four teeth for preference. To operate the ratchet-wheel, a pawl is arranged on a vibrating arm centred in the rotary valve, and connected to the end of the crank-pin of the engine, or to an eccentric on the crank-shaft, by means of a coupling-rod; the positions of the parts being such that the valve shall have a slight lead relatively to the piston—that is to say, the vibrating arm which operates the valve shall commence its forward stroke before the crank has turned the back centre. During the forward stroke of the valve (corresponding to the forward stroke of the piston), the pawl engages with one of the ratchet-teeth, and moves the valve; while during the return stroke, which corresponds to the back stroke of the piston, the valve remains at rest. Thus the commencement of one of the valve strokes causes the exhaust to close, and the gas and air ports to open; while the end of that stroke causes the valve to close the gas and air ports. The next outward stroke commences by giving more lap or cover at the port leading to the cylinder, and ends by fully opening the exhaust-port—both back strokes of the piston taking place while the valve is at rest.

Pressure-Regulators for Motors and Lighting Purposes.—Busse, J., of Dusseldorf, Germany. No. 1105; Jan. 18, 1893.

This regulator consists of a cylindrical cistern, made of strong metal plates, closed at its ends. The supply-pipe B is provided inside the cistern with a box-shaped space C, which is closed by the double sieve-plate D. A set-screw is placed on this upper sieve-plate; and it projects out of the cistern, so as to be adjustable by means of a key. The upper sieve-plate can thus be adjusted either higher or lower; the corresponding openings of the under sieve-plate being thereby more or less covered. Where the screw projects out of the cistern, there is a capsule hermetically closed by the cover. The regulator can be fixed in any gas-main, by means of the inlet and outlet pipes B and H, provided with screws, and in any place desired.



The gas arrives first in the box-shaped space C, through the openings of the double sieve-plate D. By the openings of the plate being made broader or narrower by means of the set-screw, the current of gas can be increased or diminished, as desired; the sieve-plates being set to correspond to the quantity of gas required. The cistern is thus always regulated to the amount of flame needed; the gas passing to such flame, or to the burner of a motor, through the pipe H.

Lighthouse Illumination.—Wigham, J. R., of Dublin. No. 10,328; May 31, 1892.

The inventor points out that, in his patents No. 1160 of 1879 and No. 2247 of 1891, for improvements in the illumination of lighthouses, gas-burners were described having variable powers, applicable according as the state of the atmosphere in clear or foggy weather renders it necessary. But, whereas the gas for these burners or lamps requires to be manufactured at the lighthouse, and in certain places difficult of access, or where there is not much room (such as outlying rocks and also lightships), it is difficult to erect ordinary gas-making apparatus, the present invention provides that for such places, or for any others where light is required superior to any light obtainable from oil, lights of the "Lucigen," the "Comet," the "Wells," or such-like type (in which the ordinary petroleum or paraffin or similar oils of commerce, or crude paraffin or petroleum or similar oils, heated, vaporized, and

burned as gas in the manner peculiar to those lamps) may be used. He proposes to apply such lights for lighthouse purposes, so that they may be increased or diminished in illuminating power by the use of sliding joints or ground-in swivel connections, or by flexible joints connected or unconnected with guides or rails, so as to enlarge, or diminish, or contract the diameter or height of the flame, and thus increase or diminish the intensity thereof, to suit the focal requirements of the lenticular apparatus and the varying states of the atmosphere. This is done either with the flame of one lamp or a combination of flames from several lamps, as may be best suited to the circumstances of the case, and the lenticular apparatus, whether for fixed, revolving, or intermittent lights. He also intensifies the illuminating power of these lights, by combining with their flames lycopodium, naphthalene, magnesium, strontium, or other chemical agent, for varying the colour or power of the light, by blowing them in a state of powder into the flame by means of a current of air.

APPLICATIONS FOR LETTERS PATENT.

8495.—DAVIES, W. G., "Cleaning the insides of glass chimneys used for oil-lamps, gas, or other illuminating power." April 27.
8510.—MOELLER, J., "Manufacture of oil gas." April 27.
8570.—JONES, T., "Gas-brackets." April 28.
8585.—PULLAR, A., and LEEDS, L. W., "Gas cooking and heating stoves." April 28.
8695.—TELFORD, W. H., "Mechanical appliances for loading coke and like material from ovens into waggons." May 1.
8759.—DINSMORE, J. H. R., "Manufacture of illuminating gas." May 2.
8831.—COLLINS, B. A., "Water-meters." May 2.
8849.—BEST, R. H., "Stuffing-box sliding pendants for gas." May 3.
8864.—ROBINSON, A. E. and H., "Oil or gas engines." May 3.
8913.—SOUTHALL, J., "Gas and oil motor engines." May 4.
8914.—DAVISON, J., "Automatic valve-closing engine for application to existing valves in water-mains." May 4.
8979.—THE SCOTTISH GAS-STOVE COMPANY and STEWART, J., "Boilers for gas cookers." May 5.
8981.—LITTLE, A., and REID, W. D., "Gas taps or cocks." May 5.
9141.—LAING, J., "Manufacture of gas from mineral or other oils." May 8.
9181.—ABEL, C. D., "Gas and oil motor engines." A communication from the Gas Motoren Fabrik Deutz, Germany. May 8.
9274.—STANLEY, W. F., "Mantles for incandescent lighting by gas." May 9.
9325.—WELCH, W., "Burners for the use of gas, oil, and inflammable vapours." May 10.
9454.—GREENE, T. A., and WALKER, C. M., "Street lighting." May 11.
9525.—EARNSHAW, A., and OLDFIELD, T., "Gas-engines." May 12.
9539.—BIDDER, G. P., "Improvements in pipes for the conveyance of water and other freezable liquids, to prevent bursting in time of frost." May 12.
9633.—TOBLER, A. C., "Gas-regulator." May 13.
9634.—FOULIS, W., and HUNT, C., "Purifying coal gas from sulphur." May 13.
9653.—BROWNE, A., "Gas-stoves or gas-heating apparatus." A communication from J. Danischevski. May 13.

The Newbury Gas Undertaking.—The profits of the Newbury Corporation Gas Department for the year ended March 25 last, amounted to £1423. This was not quite so large as in the previous year; but it was sufficient to meet all outgoings, and leave a balance of £229.

The Price of Gas and Electric Lighting at Shrewsbury.—The Shrewsbury Gas Company having intimated that the price of gas supplied for public lighting would be raised by 4s. per lamp per annum from March 31, the Gas and Lighting Committee suggested at the last meeting of the Town Council that they should consider the question of adopting electricity for illuminating the streets. In the report dealing with the subject, they remarked that "electricity is making great strides, is adopted by many Corporations, and the light is admittedly superior to gas;" and that "in making comparisons between the cost of gas and electricity, the enormous advantages, and in many ways economy of the latter, should not be lost sight of." The matter was discussed at some length. Alderman Southam greatly questioned the wisdom of the Gas Company in now raising their price. They had, he said, enjoyed many years of great, indeed excessive, prosperity; and now, on the first symptom of worse fortune and slightly less dividend than their usual statutory 7½ per cent., they at once rushed to the device of exacting higher rates from the inhabitants, in order to maintain the dividends. Mr. Oliver suggested that the Mayor (as a Director of the Gas Company) should convey to his Board the expression of the feeling of the Council in condemnation of the proposal to tax the ratepayers of the borough a halfpenny in the pound, so that the Directors might still be able to pay the maximum dividend. He thought it was time the Council considered whether they could not manufacture gas for their own purposes cheaper than they could buy it. Mr. Holt characterized the action of the Company as ungenerous; and he thought they ought to consider well before enforcing the increased price, or probably it would give rise to such an expression of public feeling in Shrewsbury as would lead to more important results, and a permanent lessening of their future dividends. Several other members having spoken in a similar strain, the Mayor (Mr. G. Evans) remarked that nobody more sincerely regretted the necessity of raising the price of gas than did the Company. As to what had been said about a high maximum dividend, the fact was there was hardly a shareholder who received now more than 4 per cent. The Directors were not men to do things rashly, or to desire to do anything unfair; and he was sure that any representation which the Council thought it well to make to the Company would receive every possible attention. On behalf of the Committee, the Chairman (Mr. Barker) undertook to give the subject of electric lighting their best attention.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time, and referred to the Examiners: Electric Lighting Provisional Orders Bills (Nos. 1 and 3).
Bills read a second time and committed: Blackpool Improvement Bill; Devonport Water Bill; South Staffordshire Water Bill; Stirling Water Bill.
Bills reported, with amendments: Brighton and Hove Gas Bill; Devonport Water Bill; Frimley and Farnborough Water Bill; Pontypridd Local Board Gas Bill; Stirling Water Bill.
Bills read the third time and passed: Altrincham Gas Bill; Bilston Commissioners Water Bill; East Stonehouse Water Bill; Electric Lighting Provisional Orders Bill (No. 2); Frimley and Farnborough Water Bill; Plymouth Corporation Water Bill.
Opposition withdrawn: Devonport Water Bill.

Petitions against the South Staffordshire Water Bill were presented from the Guardians of the Poor of the Stourbridge Union and the Corporations of West Bromwich and Walsall.

Petitions against the London County Council (General Powers) Bill were presented from the Berkshire and Essex County Councils, the Southwark and Vauxhall Water Company, the Thames Riparian Owners' Association, Sir Gilbert A. Clayton East, Bart., and others.

HOUSE OF COMMONS.

Wednesday, May 17.

THE WATER SUPPLY OF LLANDRINDOD WELLS.

On the motion for the second reading of the Water Provisional Orders Bill (No. 2), which contains an Order to empower the Llandrindod Wells Water Company to raise additional capital,

Mr. EDWARDS moved that the Bill be read a second time that day six months. He said the measure was opposed by the Llandrindod Wells Local Board, on the ground that it would tend to the continuance of a monopoly that was injurious to the inhabitants, and that it would increase the difficulty of dealing with the Company in the future. Although the usual course was to oppose Bills of this kind in Committee, when modifications only were desired, the Board considered that this one could not possibly be modified there, and that therefore it would be a waste of the ratepayers' money to adopt that course. If the Bill were thrown out, the Board were prepared to provide the town with a sufficient supply of pure water. They also objected to the Bill on the ground that the supply by the Company under the powers of their Act was deficient in quantity. In 1889 a Medical Inspector of the Local Government Board visited the place, and he reported that the supply did not meet the requirements of the district. The Company drew their water from the neighbouring river, which was not a proper source, because there were many villages and farmhouses on its banks. The Board were of opinion that this was simply a speculative undertaking, and that to sanction it must entail further burdens on the ratepayers.

Mr. BURT read a report by a local analyst as to the quality of the water in question, and was understood to say that the Order was simply one empowering the Company to raise additional capital. If the House were to agree to the motion, it would involve the sacrifice of the two other Orders which were scheduled in the Bill. If the second reading were agreed to, it would still be open to the Local Board to petition against the Order.

Mr. LLOYD GEORGE pointed out that the official analyst of the Local Government Board had reported against the quality of the water. There was another source of supply in the district which was much better. It would yield 200,000 gallons daily; and the quality of the water was much purer, while the supply would be under the control of the Local Board. The result of petitioning against the Order would be to entail a large expense on a thinly-populated neighbourhood.

Mr. MUNDELLA expressed the hope that the opposition to the Bill would not be persisted in. It was impossible for the House to deal with the question of this local water supply; but a petition presented to the Committee would be properly considered. It was not right that the time of the House should be taken up in settling whether this or that source of supply was the better one.

The House divided, when the motion for the second reading was carried by a majority of 42.

Thursday, May 18.

THE WATER SUPPLY OF LLANDRINDOD WELLS.

Mr. Edwards had placed on the paper the following notice in regard to the Water Provisional Orders Bill (No. 2): "That it be an instruction to the Committee on the Bill to strike out the Provisional Order empowering the Llandrindod Wells Water Company to raise additional capital."

The SPEAKER remarked that to move a mandatory instruction to the Committee to strike out one Order from the Bill was quite unprecedented. The proper course was to petition against the Order

The following progress was made with Bills last week:—

Bills read the first time, and referred to the Examiners: Bilston Commissioners Water Bill; City of London Electric Lighting Bill; Frimley and Farnborough District Water Bill.
Bill read a second time and committed: Todmorden Local Board Gas Purchase Bill.
Bills reported with amendments: Electric Lighting Provisiona Orders Bills (Nos. 1 and 3).
Bills read the third time and passed: Barnoldswick Local Board Bill; Electric Lighting Provisional Orders Bills (Nos. 1 and 3).

Petitions against the Water Provisional Orders Bill (No. 2) were presented from the Corporation of Hull and the Llandrindod Wells Local Board, in respect of the Newington and Llandrindod Wells Orders.

HOUSE OF COMMONS COMMITTEE.

Before Sir R. TEMPLE, *Chairman; Mr.* LYELL, *Mr.* MYERS, *Mr. G. R.* BENSON, *and Mr.* BONHAM-CARTER, *Referee.*)

Wednesday, March 15.

PLYMOUTH, STONEHOUSE, AND DEVONPORT WATER BILLS.

These Bills—promoted respectively by the Plymouth Corporation, the Stonehouse Local Board, and the Devonport Water Company, with the object of improving the water supply of their districts—came to-day before the above-named Committee. The Bill of the Stonehouse Local Board, to empower them to construct additional works, was taken first.

Mr. PEMBER, Q.C., Mr. BIDDER, Q.C., and Mr. A. YOUNG appeared for the Local Board; Mr. POPE, Q.C., Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN represented the Plymouth Corporation, and Mr. PEMBROKE STEPHENS attended on behalf of Mr. Tracey Elliot, the opponents of the measure.

At the outset of the proceedings, an application was made to the Committee to reserve their decision on the Bill until after they had investigated the merits of the other two; but, after consultation with the Referee, they determined to hear the case for Stonehouse before coming to any conclusion on the point.

Mr. PEMBER then opened the case. In doing so, he explained that there was a population of 15,000 within the district of the Stonehouse Local Board, which was at present very inefficiently supplied with water. Under an Act passed in 1851, the Board had conferred upon them the ordinary powers of Urban Sanitary Authorities for furnishing water to their districts; and they obtained a supply from Tor Grove, supplemented by water from the Plymouth Corporation, who had no power to supply water within Stonehouse, but could only sell it in bulk to the Board. Under an agreement with the latter body, the Corporation supplied 500,000 gallons weekly to Stonehouse. Last year, however, the Plymouth reservoir gave out, and the quantity was reduced to 300,000 gallons weekly; the consequence being that the Board had to procure a temporary supply from the Plymouth Breweries Company, who possessed artesian wells. Obviously they could not allow things to remain in this position, and they therefore determined to get the full supply of the town into their own hands. Under the present scheme, prepared by Mr. Pritchard, it was proposed to take a portion of the watershed of the River Cad, or, as it was sometimes called, the Plym. Its total area was 5885 acres; but the Board proposed to take only 1667 acres, which quantity would be further reduced to 1337 acres. Just above Cadover Bridge, a storeage reservoir would be constructed. The scheme devised by Mr. Pritchard would abundantly solve the water difficulty of Stonehouse; for it would give a supply of 25 gallons per head per day for a population of 20,000. The reservoir would occupy an area of 24 acres, and be 22 feet deep. Its capacity would be 52 million gallons; and it would be capable of being increased. Arrangements had been made to discharge, for the benefit of the riparian owners, some 288,000 gallons of compensation water per diem. The water would be conveyed in iron pipes from the reservoir to Stonehouse, nine miles distant. The estimated cost of the works was £31,500. It was a cheap scheme; and calculations had been made which showed that the cost per 1000 gallons would be 2¾d. during the first 30 years, just under 2d. during the next 30 years, and something under 1d. afterwards. Coming to the petitions presented against the Bill, the learned Counsel said satisfactory arrangements had been made with all the petitioners except two—the Plymouth Corporation and Mr. Tracey Elliot. The latter was owner of property on the Plym, below the junction of the Meavy and the Cad. This property had a frontage of 1¼ miles on the right bank of the river, and Mr. Elliot said it would be damaged because Stonehouse would take the whole of the water of the Cad. But, as a matter of fact, the Board would take only one-fourth of the watershed of the Cad, and none of the Meavy, which, after its junction with the Plym, also flowed past Mr. Elliot's property. Lord Morley and Sir Massey Lopes, who were larger riparian owners than Mr. Tracey Elliot, were satisfied with the compensation water which would be given. With regard to the petition of the Corporation, its chief feature was the allegation that the proposed new works would destroy the Plymouth leat. Under their Bill, the Board asked for powers which would enable them to pass technically either under, over, or through the leat. If they passed through it, of course they would destroy it. But they had no such intention; and proper clauses would be put into the Bill to prevent that. The Corporation also alleged that they were able and willing to give a full supply of water to Stonehouse on reasonable terms. But the events of last year made the Board seriously doubt it. Certainly, Plymouth could not do so without new works; and Stonehouse wished to have the water supply of the town in their own hands. In their present application, the Board were not interfering with any of the statutory rights of the Corporation, who, Counsel thought, should be allowed to have their Bill, and the Local Board theirs.

The following evidence was then given in support of the Bill:—

Mr. *Marcus H. Bulteel*, Chairman of the Water Committee of the Local Board, described the existing water supply of the town; and explained that the Board at present possessed service reservoirs at Pounds, with a capacity of 500,000 gallons. Under their Act of 1867, the Plymouth Corporation had power to supply Stonehouse with water with the consent of the Board; and an agreement was entered into to supply 600,000 gallons weekly. That agreement was determinable at six months' notice. The Stonehouse water was conveyed in a leat which was open and exposed in places, and consequently liable to pollution. In times of drought, the inhabitants had been put to great inconvenience for want of water; and the supply had at times to be reduced to a bi-weekly service of two or three hours only. During the dry weather of last summer, when the Stonehouse leat was almost dry, and the reservoir nearly empty, the supplementary supply from Plymouth was reduced to one-half. Inquiries were made of the Corporation as to whether or not they would give Stonehouse a larger quantity; but they were told they had not sufficient for their own consumption. The Corporation, however, informed them they might negotiate for a further supply when they obtained powers from Parliament to construct new water-works. Under their Act of 1851, the Board could only charge 1s. in the £1 for water up to a rental of £20; but in their present Bill they proposed to remove this limit, which would give an increased water revenue of £345.

Witness was cross-examined by Mr. POPE, with the object of showing that the population of Stonehouse was stationary. He, however, stated that there was one large space, besides smaller ones, in the town not yet built over; and it was estimated that the population might increase to 20,000. The Devonport Water Company had power to supply Stonehouse, and had laid mains through the town. It was a constant and excellent supply; but the price was prohibitive for the poorer inhabitants. Those who took their water from the Company had to pay water-rates to the Local Board as well.

Replying to the CHAIRMAN, witness said the people of Stonehouse wished to have their own supply independent both of Plymouth and Devonport. They thought it would be cheaper, more certain, and more convenient. If the Board supplied the whole of Stonehouse, there would be only one water-rate.

The *Earl of Mount Edgcumbe* stated that a better supply of water was much needed in Stonehouse. In his judgment, the Board were doing their duty in endeavouring to obtain an independent service. Both as Lord of the Manor and an owner of property in, and ratepayer of Stonehouse, he was anxious to support the Bill.

Mr. *S. Vosper*, Managing Director of the Plymouth Breweries Company, and a member of the Stonehouse Local Board, testified that there was a great outcry in Stonehouse for a better supply of water, with regard to both quantity and quality.

Mr. PEMBER said he had a great many more witnesses whom he could call to prove the need of a better supply.

The CHAIRMAN intimated that it was unnecessary to call them.

Mr. *E. Pritchard*, M.Inst.C.E., the Engineer of the scheme, deposed to having visited Stonehouse and carefully examined the sources of water supply, and the means for storeage and its conveyance to the town. He found the existing reservoirs insufficient to deliver water at all times to every part of the place. Under existing circumstances, he did not think they were available for the new supply. Stonehouse was at present receiving 21,000 gallons daily from their own leat, and 85,000 gallons from Plymouth—a total of 106,000 gallons. This was something over 7 gallons per head. He considered that a supply of 25 gallons per head was necessary. Of the entire watershed unappropriated, 1667 acres were available for contributing to the supply; but as some 330 acres were only partly contributory, he had excluded this portion, and reduced the area to 1337 acres. He knew of no gathering-ground in the country superior to the watershed of the Cad; as it was free from anything that would pollute or contaminate the reservoir, and the water had every appearance of being pure. The average daily flow in the whole watershed was 14 million gallons. Assuming that 4 millions were abstracted, 10 millions would still flow over the natural course. The reservoir would contain a little more than 52 million gallons, which would carry the town over a five months' drought. They had agreed to discharge 200 gallons compensation water per minute. The water would be impounded by a dam. The total cost of the scheme, including the value of the land, would be £31,500; but, in addition, £400 per annum would have to be paid to Sir Massey Lopes for his water rights. If the money were borrowed, and its repayment spread over a period of sixty years, the entire charge on the township, including the establishment charges, would be £2089 per annum for the first thirty, and £1464 for the second thirty years. This would be cheaper than the cost of obtaining water from either Plymouth or Devonport. His scheme would not in the slightest degree interfere with the carrying out of the new water-works for which the Plymouth Corporation were seeking powers. There was no intention of taking water out of the Plymouth leat; and he was quite willing to insert in the Bill a provision prohibiting the Board from doing so.

Witness was cross-examined at some length upon the details of the proposed works. He admitted that there was no difficulty in Plymouth supplying Stonehouse and other surrounding places. Gaugings of the Cad watershed were taken early in December and January, and not in summer. His original plans provided for a reservoir equal to 25 million gallons; but the larger reservoir was necessary in consequence of compensation water having to be provided. The depth of the water in the reservoir close to the dam would be 26 ft. 6 in. It was not proposed to filter the water, unless this was subsequently found necessary. Neither the Cad nor the Plym contained the peaty qualities of ordinary Dartmoor water.

The CHAIRMAN inquired what was the objection of Plymouth to the Stonehouse scheme.

Mr. FREEMAN said they objected that the source of supply was bad, the scheme expensive, and that Stonehouse could be better and more cheaply supplied by Plymouth.

In answer to the REFEREE, witness said a small service-tank would be constructed in addition to the storeage reservoir.

By Mr. PEMBER: Although no gaugings had been taken of the proposed supply in the summer, he was able to estimate the summer flow. He had reckoned it at one-third of the winter flow.

Thursday, March 16.

Additional evidence in favour of the Bill was given this morning.

Professor *H. Robinson*, M.Inst.C.E., stated that he had carefully considered the scheme of the Stonehouse Local Board, and believed they had adopted a very wise course in determining to obtain an independent supply. He examined the watershed, which was a very good one. He agreed with Mr. Pritchard that provision should be made for a population of 20,000, and a supply of 25 gallons of water per head per diem. With regard to the quality of the water, there were at times slight traces of peat and discoloration; but these could easily be removed by filtration. Provision had been made by Mr. Pritchard for the construction of filter-beds, if necessary. With a reservoir of 54 million gallons, Stonehouse would possess a storeage equal to a supply for 152 days. He saw no engineering difficulty whatever in carrying out the proposed works. The scheme was a good one, and the estimate of £31,500 was sufficient.

Cross-examined by Mr. POPE: The determination to raise the dam 5 feet higher than was shown in the original plan was made two days after he was consulted, and before Mr. Deacon was called in. The raising of the dam had nothing to do with the shallowness of the reservoir; but was rendered necessary by the fact that the Local Board had to give water instead of money compensation to the riparian owners.

Re-examined by Mr. BIDDER: The waters of the Cad formed but a very small portion of the water flowing past Mr. Tracey Elliot's property. In the dry season, its daily flow was about 433,000 gallons; and as the Board had to discharge 288,000 gallons of compensation water daily, only 145,000 gallons daily would be really abstracted from the river; and this quantity was so small that the damage to Mr. Elliot was quite inappreciable.

By the REFEREE: The additional cost of the higher dam and enlarged reservoir was included in the estimate of £31,500.

Dr. *Hill*, Medical Officer of Health for Birmingham, deposed to analyzing samples of the Devonport and Cad waters. He said the former was of excellent quality—soft, and free from contamination; that taken from the Cad, at Cadover Bridge, was almost identical with the filtered water supplied in Devonport. Both waters were slightly peaty; but neither of them was objectionable on this ground of peatiness.

Mr. *T. Leah*, Medical Officer of Health for Stonehouse, stated that almost every year since 1874, when he was appointed, he had reported to the Local Government Board upon the insufficiency of the water supply, and the necessity for improving it. He had always felt that the water supplied to Stonehouse was inadequate and of doubtful quality.

Mr. *G. F. Deacon*, M.Inst.C.E., stated that, having examined the Stonehouse Water-Works, he thought the town ought not to be allowed to depend on its present supply a day longer than was necessary. He approved of the scheme prepared by Mr. Pritchard, and considered a supply of 25 gallons of water per head per day was sufficient for both the domestic wants of the people and the trade supply. The proposed reservoir would not run dry at the end of the driest season. In his judgment, the scheme was a thoroughly satisfactory one for the supply of Stonehouse.

Mr. PEMBROKE STEPHENS cross-examined witness with the object of showing that the inhabitants of Stonehouse could obtain a constant supply of water from the Devonport Company, who had mains laid through the township.

By Mr. BIDDER: Assuming that the Company could give a sufficient supply, but charged an exorbitant price, it would be most unreasonable to compel Stonehouse to obtain its water from Devonport when the town could get water cheaper for itself.

Some conversation at this stage took place concerning the limits of deviation; and the Referee defined them as including the land which the Local Board would be able to take under the Bill.

Mr. BIDDER accepted the definition.

This concluded the case for the promoters; and evidence in support of Mr. Tracey Elliot's petition against the Bill was then called.

Mr. *C. Elliott*, a surveyor and land agent at Plymouth, stated that Mr. Tracey Elliot's property at Leigham extended 1½ miles along the right bank of the Plym, which at that spot was noted for the excellence of its salmon fishing. The diminution of the water by its abstraction above Cadover Bridge would seriously affect the value of the property, and detract from its picturesque beauty. It would also interfere with the fishing rights; and the farms along the banks would suffer if there were any considerable reduction in the water.

Mr. *Gane* said he had examined the site of the proposed reservoir at Cadover Bridge, and considered it altogether unsuitable. The depth of water was so slight that the reservoir would silt up very rapidly. The compensation water proposed to be given was very small indeed—being not more than two-thirds of the summer flow of the river; and he never heard of any compensation proposal less than the bulk of the summer flow. The stream was already reduced by diversions for mills; and therefore it was additionally important to the landowners that the balance of water remaining should not be interfered with.

Mr. PEMBROKE STEPHENS then addressed the Committee on behalf of Mr. Elliot. He said if the Committee were satisfied that there was a necessity for taking water from the Cad to supply Stonehouse, his client must bow; but unless the necessity was proved, he was entitled to remain in possession of his enjoyment. Stonehouse could obtain an adequate supply of water, if not from Plymouth, at all events from Devonport; and if the present Bill was merely the outcome of temper or pride on the part of Stonehouse, he asked the Committee not to give the Local Board the powers they asked for to the injury of his client. If the Committee sanctioned the Bill, proper compensation water should be inserted; the compensation proposed therein being quite inadequate.

Witnesses were then called in support of the petition of the Plymouth Corporation.

Mr. *E. Sandeman*, examined by Mr. BALFOUR BROWNE, stated that he had examined the plans prepared by Mr. Pritchard, and the site of the proposed Cadover reservoir, and found that the embankment across the valley would extend 160 feet beyond the limits of deviation. In his opinion, the reservoir was not large enough to provide proper compensation water. It was usual, in a scheme of this sort, to have a service reservoir between the impounding reservoir and the town; but, in Mr. Pritchard's scheme, this provision was omitted. At first it was intended to abandon the reservoir at Pounds; but now he understood it was proposed to use it as a service reservoir. The mains from Cadover to Stonehouse would obstruct the flow of water in the Plymouth leat in three places. He considered Mr. Pritchard's estimate of the cost of the reservoir and pipes quite inadequate. He (witness) calculated the cost would be £59,000.

Mr. *J. H. Ellis*, Town Clerk of Plymouth, stated that, under an Act of Elizabeth, the Plymouth Corporation had for 300 years taken all the water flowing down to the Head Weir; and under another Act, passed in the reign of George IV., they could store it by means of a reservoir, provided they could obtain the land for it. Under their Act of 1887, the Corporation did not give a drop of compensation water except for a little stream, the course of which was below the Head Weir. Under their present Act, the Corporation would take the water from an additional 475 acres; and it was for this alone that compensation water was to be given.

In cross-examination by Mr. BIDDER, witness denied that the Corporation last year curtailed the supply to Stonehouse, except for three or four days in the summer. Under their agreement, the Corporation contracted to supply Stonehouse with 600,000 gallons of water per week; but this quantity was reducible to 300,000 gallons per week in the event of the water in the Plymouth leat falling below a certain level. This happened for a few days last summer; but the water supplied to Stonehouse was not reduced below the contract quantity.

The CHAIRMAN asked witness to state, in a few words, the nature of the objection of the Plymouth Corporation to the Bill.

Witness said the first objection was that the application of Stonehouse was for the purpose of "putting the screw" on to the Corporation and the Devonport Water Company, and was not a *bonâ fide* one. Asked if there was any other objection, he said there were many people in Plymouth and Stonehouse who thought both places would be better governed and more cheaply supplied with water if they were amalgamated; and the movement of Stonehouse for an independent water supply was simply to place them in a better position to meet an application for the extension of the Plymouth borough boundaries, should it be made. If the Stonehouse Bill were not allowed, the Plymouth Corporation would not attempt to take in the watershed of the Cad for the joint supply of the borough and Stonehouse, because their own watershed was ample for both towns. In the future—it might be remote—the growth of Plymouth might render it necessary to take in the Cad watershed.

By Mr. MYERS: In the event of the Plymouth Bill passing, the Corporation would be in a position to give Stonehouse a continuous supply of pure water on fair terms. If they could not agree upon terms, they were willing to let an inspector or an engineer of the Local Government Board arbitrate between them.

The REFEREE: You have imputed nothing to Stonehouse. I should like to ask whether your opposition to this Bill is not to throw the Local Board of Stonehouse into the arms of Plymouth.

Witness said no; because they could have the water from either Plymouth or Devonport. Asked further in what way Plymouth would be injured if the Stonehouse Bill passed, he replied that, in the event of Stonehouse being at some future time incorporated with Plymouth, they would be saddled with a very heavy debt for water-works which would be useless.

The Committee then adjourned until the following day.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, May 16.

(*Before Justices* CHARLES *and* VAUGHAN WILLIAMS.)

Young v. The Southwark and Vauxhall Water-Works Company.

This action came before their Lordships, sitting as a Divisional Court, in the form of an appeal on a special case stated by Mr. Plowden, the Magistrate sitting at the South-Western Police Court, in respect to a summons taken out for the Vestry of St. Mary, Battersea, by Mr. Young, acting on their instructions, which his Worship dismissed, on Dec. 17 last, but without costs.

Mr. ERLE appeared for the appellant; and Mr. M'CALL, Q.C., with a junior, represented the respondents.

Mr. ERLE said that a summons was taken out against the Water Company under section 49 of the Public Health (London) Act, 1891, for not having given notice of their intention to cut off, and cease to supply with water an inhabited house, No. 79, Mallison Street. This clause provided that such omission was liable to a fine of £10; and it placed upon the Sanitary Authority the duty of taking proceedings. The question that came before the Magistrate was whether what was done was within the meaning of the section to which he had referred. The case, as stated, was that the point was whether turning off a stopcock, for the purpose of attending to a leak, was such a cessation of supply as required notice to be given; or whether the cutting off was not a cutting off at the point of junction between the communication pipe, which is the property of the consumer, and the main, which is the property of the Company. The respondents were providing a constant supply of water to the district in question; and they did so until Nov. 2, 1892, when the stopcock was shut down which supplied the water from the mains. A leakage occurring between the stopcock and the house, the respondents were communicated with; and they caused the cock to be shut down. The effect of this was to stop the leak, and also to prevent any fresh supply of water to the house; and the respondents did not, in fact, supply any such water from that date until Nov. 25, when, the leak having been repaired by the landlord, the supply was renewed by the landlord's plumber opening the stopcock. It was admitted that no notice was given to the Vestry; but on Nov. 8, such notice was given to the landlord. The Magistrate found that the matter was one of urgency, and it need only have been one of mere temporary inconvenience had the occupier communicated with the landlord at once. There was no intention on the part of the respondents to withdraw the supply of water from the premises, except for the immediate purpose of stopping the leak. Being of opinion that the Company had acted rightly in law, the Magistrate dismissed the summons against them, but without costs, thinking that the Vestry had no choice but to proceed. The question for the Court was whether the Magistrate was right; and if not, what ought he to have done? The learned Counsel proceeded to point out that this decision would appear to have been founded on the case of *Milnes v. The Corporation of Huddersfield*.* Section 48 of the Public Health Act of 1891 decreed that an inhabited dwelling-house without a sufficient supply of water was to be deemed a nuisance, and as such was to be dealt with by the sanitary authority.

* See JOURNAL, Vol. XLVII., pp. 496, 1010; and Vol. XLVIII., p. 150.

It was for the purpose of enabling the sanitary authority to carry this out, that notice was to be given under section 49; and the authority was binding in every case to take proceedings against the water company failing to give the requisite notice. In this case, he did not follow Mr. Plowden's findings upon that point, because he seemed to have decided that it was incumbent on the Vestry to take proceedings; and if there was no offence, why take out the summons? As far as the practical effect was concerned, it was precisely the same whether the turning off of the water was by means of the iron ferrule to be got at by opening the road and digging down to the main, or by turning off the stop-cock in the public footway, from which point the water was prevented from getting into the house.

In answer to Justice VAUGHAN WILLIAMS, the learned Counsel said the Company gave a continuous, and not simply an intermittent supply within the meaning of the Metropolis Water Act of 1871; and in that case, a consumer could be required to fix a stopcock in or about his premises, by which means a constant supply could be, if necessary, turned off. In this instance, the stopcock was fixed in the public footpath; and he did not question that it was put down by the consumer at his own expense. He should call attention to a clause in the Water Company's Acts, giving them power to put in the public footpath, in the connection-pipe of the consumer, a stopcock for the very purpose of stopping a leak. It was known by the Company that the water was off, because six days afterwards they gave notice to the landlord, requiring him to stop a leak; and the result was that the house for 23 days remained in a state which the Act of Parliament declared to be a nuisance. It would defeat all the purposes of the Act, if they did not get notice, so as to do their duty. He proceeded to call attention to section 32 of the Metropolis Water Act of 1871, section 13 of the defendant Company's Private Act of 1884, and section 18 of their Act of 1886; and he said the question was not whether they supplied some inches of pipe inside or outside the premises, but did they supply the house or district from the pipes which were the property of the consumer. If they turned the stopcock inside the premises, to prevent the house getting water, that was a thing of which they had to give notice. The words of these Acts showed that the Company might take any steps to stop such supply, and remove any part of the stopcock which was their property.

Justice CHARLES said it seemed to him quite impossible to hold that the mere ceasing to supply was an act of which notice must be given to the Sanitary Authority.

Mr. ERLE remarked that he had not contended for that.

For the respondents, Mr. M'CALL urged that the finding of the Magistrate was upon a question of fact; and there was clearly no offence here.

Justice CHARLES: He has left the contentions of the appellant and respondents pretty much to this Court.

Mr. M'CALL said he would submit that a criminal offence could not be created by the neglect of the landlord to do something which he should have done. Had he done as he ought—viz., put the leak right and turned on the tap—even his learned friend did not pretend there would have been an offence. But he put the respondents' case even higher than that. He submitted that, when their Lordships looked at the legislation on this subject, it was perfectly clear that the section in point was not intended to cover a case of this kind at all. The Water-Works Clauses Act of 1847 (sections of which were embodied in the Private Act of the Company), provided by section 48 that the consuming pipe should be the property of the consumer; by clause 53, that the stopcock and communication-pipe should also be the property of the consumer; and by clause 74, that if the consumer neglected to pay the water-rate, the Company might stop the water from flowing into the premises by cutting off the pipe.

Justice CHARLES: And it goes on to say: "Or by such means as the undertakers shall think fit."

Mr. M'CALL said that was so. There were two ways of cutting off the water. One was by bending the pipe, which was usual when they were made of lead; but where the constant supply was introduced, the pipe was fitted into the main by a ferrule, and the water was cut off (when the Company were entitled to do so) by unscrewing the connection-pipe, which had this ferrule at the end, and placing a screw in the main to prevent it leaking. The learned Counsel went on to point out other powers of the Company under section 16 of their Act of 1863, and section 32 of the Act of 1871.

Justice VAUGHAN WILLIAMS remarked that he supposed the learned Counsel held that cutting off and turning off were two different things; and he dealt only with the cutting off.

Mr. M'CALL said that depended in what sense the words cutting off and turning off were used, in relation the one to the other. If the plumber were to turn off the tap inside or outside, no notice would be required; and if the Company's men, for the purpose of stopping a leak, turned off the tap inside notice would also not be required. Could it make any difference, as a criminal offence, if he turned off the tap in the road, which would require a key of a certain length to reach it? It was a fact that the Company were not liable in respect to the water after it entered the connection-pipe; and he contended they were not liable under this summons.

In delivering judgment, Justice CHARLES said he thought it clear that a mere temporary cessation did not cast upon the Company the responsibility of notice. If that was so, whether they had cut off and ceased the supply, was a question mainly of fact rather than of law. Having regard to the findings of the Magistrate in this case, he was quite unable to overrule his decision. He might have taken a different view of the matter; but it was impossible for him (the learned Judge) to review that decision on a question of law. True, there was considerable delay in arriving at the leakage; but it was equally a fact that the Water Company cut off the water as a matter of urgency, and solely for the purpose of repairing the leak. The servants of the Company also told the tenant he had better communicate with the landlord at once, and get the pipe repaired. In these circumstances, he was unable to say that the Magistrate was wrong in the conclusion at which he arrived.

Justice VAUGHAN WILLIAMS said that, confining himself to the facts as revealed in this particular case, he was of the same opinion.

The appeal was consequently dismissed, with costs.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS AND WATER SUPPLY.

At the Meeting of the Birmingham City Council on Tuesday—the MAYOR (Mr. Alderman Lawley Parker) presiding—the annual reports of the Gas and Water Committees, the principal portions of which appeared in last week's issue, were presented for adoption.

The Gas Committee's Report—Workmen's Holidays.

Alderman POLLACK submitted the report, and moved that the Committee should be authorized to appropriate the sum of £27,996, being the net profit of the Gas Department for the year ended March 31 last, to the credit of the improvement rate of 1892. He said the sum referred to was made up of three items—the usual contribution of £25,000; £2855 arrears of last year's contribution, which only amounted to £22,144; and £110 the balance of surplus. If the resolution stood by itself without explanation, it would point to there having been a prosperous year; but the contrary was the fact. It had been a year of the greatest anxiety to the Committee, and one of hard struggle to keep faith with the Finance Committee. They were only able to submit the recommendation embodied in the resolution by suspending the usual provision for maintenance and renewal of works, which was indispensable if they were to keep up their efficiency without considerable additions to capital expenditure. They had also suspended the statutory instalment to the sinking fund—a proceeding which, although not desirable, was excusable when they remembered that two years ago they were able to place the large sum of £45,000 to the credit of this account. It would, however, be disastrous to the future welfare of the Gas Department if provision for the maintenance and the renewal of works had to, be suspended again to any marked extent. The Committee were however, aware some ten months ago—immediately after their contracts for coal and tar were made—that it would become necessary to adopt the course they had taken, unless they had a windfall in the direction of a greater consumption of gas or higher prices for sulphate of ammonia. Their hopes in this respect were not realized. The sale of gas only showed an increase in revenue of £1700, which was equivalent to about one-third per cent. In the previous year, the increase in the output of gas was 235 million cubic feet—the largest on record; while in the year just ended the increase was only 19½ million cubic feet—the smallest on record. Of that 19½ million, some 14 million cubic feet went to the new supply to Sutton Coldfield, so that practically the increase had been only about 5 million feet. The smallness of the increase was entirely due to the wonderful change which had taken place in the climate. During the past six months of 1892, when the weather was normal, they had an increase in the consumption of 6⅓ per cent.; while in the first quarter of the last financial year, there was a decrease of 7¾ per cent., and, in the quarter ended March last, there was a decrease of 3¼ per cent. With the return of weather of the usual character, an increase of consumption was inevitable; while, even with a continuance of the present bright weather, he foresaw no further considerable falling off. Turning to the revenue account, Alderman Pollack said that among the additional expenses was £5600 in respect of new purifying processes, whereby there had been a reduction of the sulphur compounds in the gas, although not to such an extent as to satisfy the aims of the Committee. The wages at the works showed an increase of £2387, due principally to the additional quantity of coal carbonized. The wages of the men employed in carbonizing now amounted to £59,303; but this did not include the wages in other departments, which reached to no less than £61,910—bringing up the wages total of the department to £121,220. Owing mainly to the adoption of eight-hour shifts, wages had grown rapidly, and were now from £25,000 to £30,000 higher than they would have been if the conditions and hours of employment and rates of wages of five years ago were still in force. Rates and taxes were £3450 more than in the preceding year; £600 had been spent in painting and decorating the offices and warehouses; £700 on the improvement of the Nechells recreation ground; and there had been a bill for £1700 law charges, principally in connection with the Staffordshire rating appeal. The discounts and adjustments on the gross sale of gas were nearly £5000 higher than the amount shown in the previous balance-sheet, when, for reasons which he fully explained on a former occasion, they availed themselves of an accumulated surplus to the credit of the discounts and bad debts account. This reduced the revenue from gas to £3000 less than in the previous year. The profit on gas-fittings showed a decrease of £600; and the revenue from coke a falling off of £3658, which, however, was not large when it was remembered that they had reduced the price of coke 2s. a ton. The net revenue from coke (£67,321) was very large in comparison with former years. There was at no time during the year a heavy accumulation of stock, and that now stacked was all sold for summer contracts. Ammoniacal liquor showed a decrease of £1166. But this residual had now turned the corner; and from the new contract coming into force in July, as well as from the rise in sulphate of ammonia, the Committee expected to receive a considerable additional revenue. The receipts from tar were nearly £13,000 less than in the preceding year; and the price at present was barely one-half what was obtained ten years ago. These items of greater expenditure, or reduced income, represented an aggregate sum of £36,000. On the other side, the gains were very little. There was a reduced expenditure on repairs to mains and services of £1300; and a saving in the cost of coal to the extent of £8935, to which should be added £1000, representing the cost of coal for the additional quantity of gas made. Although the reduction in cost was relatively small, compared with the rise of £75,000 in the previous year, it was large in the face of last year's determination of the coalowners not to abate their price. They had to make up their minds either to break with old friends or to submit to their dictation then and for the future. They chose, reluctantly, the first expedient, and had recourse to new sources of supply which offered them an advantage. The result justified their policy; for they had not only effected a saving, but their old friends had offered them much more favourable contracts for the ensuing year. The saving of £10,500, against an increased expenditure and reduced revenue of £36,000, together with the additional sum, to be paid to the Finance

Committee above that of last year, and the reduction of interest from the bank, gave the Committee in all a deficiency of about £32,000 to meet. There were two ways of doing this—either by increasing the price of gas by 2d., which would have given them the required sum, or by suspending for the past year the usual provision for maintenance and renewal of works. To have adopted the former course would have been to check consumption and to promote resort to other illuminants, and have been an indirect tax upon the already heavily-burdened ratepayers. Under all the circumstances, therefore, they had thought it better to take the second course.

The motion was seconded and carried.

Alderman POLLACK then moved, and Mr. W. F. GREEN seconded, the adoption of the report.

Mr. JACOBS asked whether, in view of the loss of £600 on the fittings business, the Chairman could not see his way to carry out the promise he was understood to give on a former occasion to discontinue this department, which competed disadvantageously with private traders.

Mr. BLOOR called attention to the subject of a memorial from the short-term carbonizers on the subject of holidays. The report referred to holidays given to certain of the workmen, at a cost of £1500 a year. He wished to know how many men were included in this return, and also what was the number of holidays granted to other employees, including the salaried staff, and the cost they entailed. He thought that what the short-term carbonizers asked for was very reasonable, and he would move an amendment—"That the report be approved, and that it be an instruction to the Gas Committee to make arrangements to allow holidays to the short-term carbonizers on the basis of one day's holiday for two months, two days for six months, and three days for eight months."

Mr. JONES seconded the amendment.

Mr. BOWKETT asked whether there was likely to be a decrease in the price of gas. At Widnes the charge was 1s. 10d. per 1000 cubic feet to ordinary consumers, and 1s. 8d. to large consumers.

Mr. GREEN said the Committee had been considering the question of holidays ever since December last. It could only be by an accident that a short-term carbonizer worked for eight months without getting a holiday. He was entitled to the Bank Holidays, on condition that he had worked for three months prior to each. Mr. Bloor's proposal would make his position better than that of other workers who were not carbonizers. It was impossible, in fact, to disturb the present arrangements without unsettling the entire staff of that and other departments.

Mr. GRANGER contended that the short-term carbonizers should not be treated as casual labourers. Although there was not sufficient work to employ them all the year round, they came year after year to the gas-works. The week's holiday to permanent employees of the same class was granted because of the severe character of their labour, and something commensurate was due to the short-term men on the same grounds. He condemned as impracticable, and of no economic utility, the new inclined retorts with which the Committee had been making experiments; and he declared that the kind of labour they exacted was not defensible on grounds of humanity. Let the members of the Committee take a turn in the hot "cellars," and see how they liked it.

Mr. OSLER observed that a profit of £27,000 a year amounted only to 1¼ per cent. on the capital, and was quite inadequate. The Committee should aim to realize £50,000 at least.

Mr. STEVENS pointed out that the London County Council gave to all their employees thirteen days' holiday in the year; and he did not think any servant of the Birmingham Corporation, however mean his occupation, ought to be satisfied with less holiday than a week.

Mr. BEALE reminded the Council that since 1878 the plea for holidays had steadily extended from one class of men to another, and had been resisted on principle. A holiday was granted to the long-term carbonizers because their occupation was said to be very laborious, and injurious to their health, and a holiday was necessary to them. The Council, in considering every new demand, must be careful not to be dragged into an inconsistency. In this case the proposal was disapproved by the Committee, not because of the cost, but because its acceptance would create irresistible claims in other directions.

Alderman POLLACK, in reply, remarked that the Committee had not made a loss of £600 on the fittings department, but had made £600 less profit. The profit nevertheless amounted to 7½ per cent.; and he did not think it a bad dividend. As to the price of gas, he happened to know that the Widnes Corporation charged 1s. extra per 1000 cubic feet to persons who lived outside its own boundary, who formed the greater number of the consumers. Further than that, Widnes made a loss on its gas-works in 1891. With reference to the inclined retorts, he had been in the so-called "cellars" very frequently. There was at first some complaint; but the over-heating of the place had been remedied by putting in ventilators. He agreed with Mr. Osler that the profit was small; but he pointed out that, including £4000 for interest on the reserve fund, and a reduction of £10,000 in the cost of public lighting, it worked out at £40,000. As to the holidays, the total number of days given to the men was 6500; and the men were about 1500 in number. About 540 of them had a week's holiday; and the remainder had Bank Holidays. The number of officials, including the Engineers and the Secretary, was about 150; and the total number of days given to them was 2500, or fourteen days each. But the cost of their holidays was not a farthing to the Gas Committee, inasmuch as their work was made up by those clerks who remained. The decision of the Committee was thought by all their number, except one, to be just and fair In a sense, the one day in four months granted to the short-term men was not, indeed, a holiday at all. They had to work all the time, and what they obtained was a day's extra pay. The heavy work in consideration of which the holiday to the full-term carbonizers was granted, had been lightened. There were two eight-hour instead of twelve-hour shifts. When it was granted, an outlay of £540 was contemplated; but the Committee had allowed that outlay to grow to £1500. If they consulted their own inclinations, they would accept the amendment for the sake of peace; but, in the interest of the Corporation, they were bound to resist it.

The amendment was then rejected by 43 votes against 19; and the report was adopted.

The Water Committee's Report—The New Water Scheme.

The MAYOR (in the absence of Sir Thomas Martineau through indisposition) moved the adoption of the report of the Water Committee, and said it would be seen that it was intended for the whole of the members of the Committee to form the Construction Committee for the new water undertaking. He thought the Council would appreciate this recognition by the Committee of the great importance of the matter. As to the appointment of Secretary to the department, there were 171 applications. In the first instance, the applications were referred to the Finance Sub-Committee, with instructions to select the most suitable candidates. The Sub-Committee, when they approached the subject, hoped to find applications from secretaries or managers, or sub-managers, from some of the largest water companies or corporations, and among those candidates men possessed of the fullest knowledge of the subject, and having personal qualifications of a high order. There was one such candidate; but, unfortunately, this gentleman's merits were appreciated by the Corporation in whose service he was, and, when they found that he was a candidate at Birmingham, they raised his salary very considerably, and entered into an agreement by which they retained his services for a term of years. The others were either subordinates in large works, or secretaries or managers of very small concerns. After mature consideration, the Committee decided to appoint Mr. E. A. Lees. With regard to his testimonials, the Chairman of the South Staffordshire Water Company wrote expressing the opinion that Mr. Lees would be able to perform the duties satisfactorily, and strongly recommending him from personal knowledge; and the General Manager of the Metropolitan and Birmingham Bank wrote stating that Mr. Lees was well qualified for the post he applied for. With reference to the great water scheme, the Committee considered, as to the division of the engineering duties between Mr. Gray and Mr. Mansergh, it would be better that each engineer should be solely responsible for the work he undertook, rather than that there should be divided responsibility in reference to it. Nevertheless each Engineer would be at liberty to make representations to the other in reference to his colleague's part of the work, when it appeared to him that such representations were likely to be of service. As to the construction of the dams by the Corporation, it was believed that this procedure would be the more economical; but the first consideration with the Water Committee was that of safety. In view of the possibility of a contractor, in order to make money, scamping the work, or of an under-contractor covering over bad work, Mr. Mansergh very strongly recommended that the Corporation should undertake this part of the work themselves. After all, the responsibility rested with the Engineer; and, if the Water Committee had disregarded his recommendation, the responsibility would have rested on them if anything had happened. Therefore, the three dams were to be made by their own workpeople, under Mr. Mansergh's supervision. The railways and the first section of the aqueduct, that from Caban Coch to Knighton (which, of course, as all the other work, except the dams, would be done by contract in the ordinary way), would be proceeded with at the same time. This first section of the aqueduct would amount to 21 miles, one-third of which would be tunnelling; and it was this work which, with the dams, would take the longest time. The Committee were very anxious that there should be no waste of capital, and were therefore endeavouring to commence the larger works first, so that as nearly as possible the whole should be completed at the same time, instead of having a large amount of work paid for and standing idle. They were indebted to the Chairmen of other great water undertakings for valuable suggestions on this point. Alluding to the duplicate mains between Whitacre and Plant's Brook, the Mayor said that, when the recommendation was made, the Committee had not contemplated any change in the source of supply; but now the city was to have water from Wales, they would not be wanted for longer than five years. The figures given in the report showed that the Committee had not under-estimated the prospective increase in the income from water-rents. If they had a reduced price of coal, and new services in proportion to the number of houses which had been and were being built, he hoped the profits would be on a larger scale next year.

Mr. FALLOWS seconded the motion.

A discussion followed, the tenor of which will be gathered from the Mayor's reply.

The MAYOR, in reply, said there was an important consideration—whether they would be prepared to disregard the advice of one of the first engineers in England on the question of the construction of the dams; for himself, he dare not undertake such a risk. If they appointed Mr. Mansergh as their Engineer, they were bound to be guided by his advice in engineering matters. As to the carrying out of the work, he urged that it would be done quite as cheaply, and perhaps cheaper, by the Committee; and there would be less anxiety and risk than if they placed the work in the hands of contractors. As to the cost of the estates they required, the Committee did not intend to supply these particulars, because it would be detrimental to the public interests to do so. Neither could they give any information with regard to the payments to Mr. Mansergh, because they had entered into an agreement that they would not do so; and it was most distinctly in the public interest that they should refuse the information.

The resolution was agreed to.

The Price of Gas in the Metropolis.—At a meeting of ratepayers held on Monday evening last week at the Banner Street Hall, St. Luke's, under the presidency of Mr. Rowlands, M.P., a resolution was passed urging The Gaslight and Coke Company to reduce their charge for gas, and calling upon the London County Council to take up the question, so that a uniform rate shall be charged for the whole of London.

Extension of the Pontypridd Water-Works.—The Directors of the Pontypridd Water Company have resolved to proceed at once with the construction of all the works authorized by the Act they obtained last year. The extensions include the construction of a large reservoir, at a point two miles above the present reservoir at Mardy, and additional filter-beds. The work of laying a new main from Ferndale to Williamstown will be commenced within a few days.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the London Offices, 30, Gracechurch Street, E.C.—Mr. ALFRED WILLIAMS in the chair.

The SECRETARY (Mr. S. Wood, F.C.A.) read the notice convening the meeting; and the report and accounts, to which reference was made in the JOURNAL for the 25th ult., were taken as read.

The CHAIRMAN, in moving the adoption of the report, said perhaps he ought to state that the Company had, to a certain degree, suffered in their gas-rental, in consequence of the Electric Light Company taking from them some of their customers; but still there was no cause—in the opinion of the Directors at any rate—for any fear that they would suffer very much, because, as would be noticed by the accounts, the profit for the half year had come out almost identically the same as when they supplied the whole of the public lamps. The Directors believed this state of things would continue. They had imported into Georgetown some of the new incandescent lights; and, by means of these, they hoped to do even better than at present, and probably take away some of the Electric Light Company's customers. They did not wish harm to anybody; but it was their duty to do all they could for the good of the Gas Company.

Mr. CHARLES GANDON seconded the motion, which was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. R. BERRIDGE, dividends were declared on the preference capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 6 per cent., both less income-tax, except upon the dividends payable to local shareholders.

The retiring Directors (Messrs. C. Gandon and G. Russell Garnett) were re-elected on the Board, on the motion of Mr. E. K. BLYTH seconded by Mr. J. MANWARING.

Mr. GANDON thanked the shareholders for their renewed testimony of confidence in him and Mr. Garnett, who, he mentioned, was the Georgetown Director of the Company. They knew from his correspondence that he took a great interest in their affairs; and, being a gentleman with considerable local influence, he could help the Company very materially—perhaps even more than the London Directors could do.

The retiring Auditor (Mr. Magnus Ohren) having been re-appointed,

Resolutions were passed acknowledging the services of the Chairman and Directors, the Secretary (Mr. Wood), the Local Secretary (Mr. F. A. Conyers), the Engineer (Mr. T. B. Younger), the Auditors (Messrs. Ohren and Manwaring), and the Solicitor (Mr. E. K. Blyth).

The proceedings then terminated.

BAHIA GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Thursday, at the London Offices, 9, Queen Street Place, E.C.—Mr. EDWARD HORNER in the chair.

The SECRETARY (Mr. T. Guyatt) read the notice convening the meeting; and the Directors' report and the accounts, of which a summary appeared in last week's issue, were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that the working during the six months ending Dec. 31 last had been good, both as regarded the make of gas per ton of coal and the quantity accounted for, notwithstanding the higher cost of coal and the additional loss on exchange, as compared with the corresponding period of 1891. The net profit enabled the Directors to recommend the usual dividends, and to increase slightly the undivided balance. The increased cost of coal was due to the strike of Durham miners last year, and the vexatious quarantine regulations of the Brazilian authorities. The only other items on the debit side of the revenue account calling for notice were those of rent and taxes and trade charges. The increases were entirely in Bahia, and were quite unavoidable. The credit side of the revenue account was very satisfactory—showing a total advance of £1869; thereby compensating for the extra cost of coal and loss on exchange on the other side. Turning for a moment to the balance-sheet, it would be seen that the sum owing by the Government for public lighting on Dec. 31 was £9736. When negotiating for a prolongation of the concession after Feb. 9, the Company made it one of the conditions that the whole of the arrears must be paid without delay, and that the monthly accounts for the current period should also be paid when due, failing which they should carry interest. The terms were accepted by the Governor, with the result that the recent advices from Bahia brought the gratifying intelligence that all the arrears had now been paid, as well as the current monthly accounts, and that only the public lighting account for April was owing at the present time. Referring to the paragraph in the report on the subject of the concession, he said that the Government of the State not having given the agreed notice to determine the prolongation at the end of six months, the term would not expire until February, 1894.

Mr. HORATIO BROTHERS, in seconding the motion, congratulated the shareholders on the prolongation of the concession; and said he believed, if they went on a little longer, they would be able to pay 20s. in the pound.

Mr. FOGG inquired if the Company had a Committee of Management in Bahia. He was connected with other foreign companies in which they had two or three gentlemen to manage the local affairs; and it was found to work exceedingly well.

Mr. H. FINLAY remarked that the Company had been going on for about 30 years, during which time they had not had a Committee. At present they were admirably represented in Bahia by their Manager (Mr. G. Martin), who was with them that day, and who spoke the language fluently. He had been in Brazil some eight or nine years, and was well acquainted with the authorities.

Mr. BROTHERS pointed out that they had no shareholders in Bahia; and it would be rather dangerous to have men to manage their affairs who had no interest in the concern.

Mr. MACHELL thought it best to "let well alone." He was certain their Directors who had carried them on up to now, were quite capable of continuing to do so.

The motion was then carried.

On the proposition of the CHAIRMAN, seconded by Mr. FINLAY, dividends were declared at the following rates per annum: 10 per cent. on the 10 per cent. preference capital, 7½ per cent. on the 7½ per cent. preference capital, and 8 per cent. on the ordinary capital.

The CHAIRMAN proposed a vote of thanks to the officers of the Company in London and Bahia.

Mr. BROTHERS, in seconding the motion, remarked that, since Mr. Martin had been in Bahia, he had shown great ability in the conduct of the works; and he had never been exceeded as a manufacturer. In Mr. Martin's absence, Mr. Mansell had been acting as Manager; and the work had certainly gone on in an extremely satisfactory manner. With regard to their Secretary, he must say that he had helped them out of a good many difficulties which they previously had.

The motion having been passed,

Mr. MARTIN said it gave him much pleasure to be able to personally thank the shareholders for this vote, as well as those which had been passed on former occasions. He felt it a great honour that he had been successful enough to deserve such a vote; and he assured the shareholders that he should not relax his efforts to please them in the future.

The SECRETARY having also acknowledged the vote,

On the proposition of Mr. JABEZ CHURCH, seconded by Mr. COGAR, a complimentary vote was passed to the Chairman and Directors; and the proceedings terminated.

CAPE TOWN AND DISTRICT GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Friday, at Winchester House, Old Broad Street, E.C.—the Hon. HENRY NOEL in the chair.

The SECRETARY (Mr. J. A. Kelman) having read the notice convening the meeting,

The CHAIRMAN moved a resolution adopting the report and accounts for the year ending Dec. 31 last, and declaring a dividend of 2½ per cent. He remarked that it would be in the recollection of the shareholders that the accounts presented at their last meeting showed a loss of upwards of £1000; and a full explanation was then given as to how this negative result had accrued. Shortly, it was that the works themselves were exceedingly old, having been erected in 1845; that the storeage capacity was totally inadequate to the demand; and that there was no communication between the old works in Cape Town and the new ones at Woodstock, so that one works could not supplement the other. The consequence was all these matters had to be taken in hand at the same time; and so there was no possibility of exercising economy in the general management. At the last meeting, he also informed the shareholders that they had three strings to their bow, upon which they could rely for improving their position. The first was that there might be an increase in the consumption of gas; the second was that they would be able to secure a great saving in the unaccounted-for gas; and the third was that they could realize a larger yield per ton of coal carbonized. With regard to the unaccounted-for gas, this resource was entirely in reserve still; and, when he mentioned that the leakage amounted to about 5 million cubic feet, the shareholders would see what immense scope they had there for improvement. Then the amount of gas produced per ton of coal carbonized was very low—something like 7000 cubic feet; so that in this there was also a means of improvement. As to the consumption of gas, it was advancing, to use a well-known phrase, "by leaps and bounds"—the increase, in fact, had been about 20 million cubic feet. The result was that, instead of there having been a loss of £1000, they had happily turned the corner, and had a net profit of £3368. The dividend of 2½ per cent. which they recommended would absorb £2500, and leave £868 to be carried forward. There was one other matter he ought to mention to the shareholders with reference to their coal supply. The reason why the make of gas had been so small per ton was owing to the exceedingly inferior character of the coal they had been using. Under advice, the Directors last year sent out to the Cape a somewhat large consignment of coal which did not appear to be suitable for the climate; and it deteriorated in a most extraordinary way—in a manner, indeed, that defied all previous experience. They had discontinued sending out this coal; and had reverted to the original coal with which the old Company prospered so largely.

Mr. R. A. FAIRCLOUGH seconded the motion.

The CHAIRMAN, in reply to a question, stated that the old mains were all honeycombed; and new ones were now being put down.

The motion was unanimously carried.

The retiring Director (Mr. Fairclough) and the Auditors (Messrs. Deloitte, Dever, Griffiths, and Co.) were re-elected.

HEYWOOD CORPORATION GAS DEPARTMENT.

The Price of Gas and the Profits.

At the Meeting of the Heywood Town Council last Friday week, the minutes presented by the Gas Committee stated that the balance-sheet for the year ending March 25 last showed a profit of £36, which it was proposed to place to the credit of the profit and loss account. In moving the confirmation of the minutes, Alderman Firth said there was nothing out of the ordinary way to comment upon. The Committee were not in a very satisfactory position in regard to their stoking machinery; but they hoped to get it right soon. The strike in the cotton trade, and the decline in values of residuals, together with the extra expenditure owing to the large increase in the consumption, were the principal causes of reduced profits. Had the price of residuals remained the same, and the charge for maintenance been normal, the profit would have been more than £1000, notwithstanding the heavy

leakage. He added that it should be remembered that, out of 110 of the largest towns in the country, 90 per cent. had increased the price of gas, varying from 2d. to 5d. per 1000 cubic feet. The motion having been seconded, Mr. Taylor asked how the Committee had received the application of the Watch and Park Committee for a reduction in the price of the gas used for lighting the public streets. The Gas Committee would have been in a worse position if it had not been for the larger amount the Lighting Committee had paid them. Mr. Greenhalgh did not think the Watch and Park Committee were dealt with as they ought to be. He did not see why consumers of gas for cooking and heating should have a supply at 2s. 11d. while the Committee who used so much for street lighting were charged 3s. 4d. Mr. Marlor thought the efforts put forth by the Council in reducing the price of gas for stoves and motive power had resulted in benefit to the borough. If they could supply motive power at a cheap rate, they would induce people to come into the town, where rates were comparatively low, and introduce small manufacturing businesses. Alderman Cronshaw said the balance-sheet would settle the question of profits. The whole tendency of the Council had been to bring down the price to just what it would pay at. Therefore he could not understand the Chairman of the Watch and Park Committee when he said they would have been worse off but for that Committee. Alderman Firth said if he could see his way to reduce the price of gas all round, he should be very pleased to do so. They ought to encourage the use of gas for stoves as much as possible, because they were used in the daytime and summer, when the lighting consumption was at its lowest. Since they began to supply stoves, they had fixed 300; and these last year consumed nearly 6 million cubic feet of gas. The minutes were approved.

Electric Lighting for Wakefield.—Early this year, the Sanitary Committee of the Wakefield City Council appointed a Sub-Committee to consider the advisability of providing a supply of electricity for public and private purposes. As a result of their inquiries, they have recommended the Council to take steps to obtain a Provisional Order to give them the necessary powers. The recommendation has been adopted; and the Sub-Committee have been directed to further continue their investigations.

The Profits on the Burslem Gas Undertaking.—In submitting the report of the Gas Committee at the last meeting of the Burslem Town Council, Mr. Hulme explained that there had been a decrease of £500 in the receipts for gas, as compared with the previous year. He thought it exceedingly satisfactory that notwithstanding they proposed to pay £2965 this year off the expenditure incurred during the past twelve months in erecting a new gasholder (£7400), they were able to recommend that £2000 should be taken from the profits in aid of the general district rate.

Sales of Shares.—At sales by auction at Sheffield last Tuesday, £500 of "C" stock in the *Sheffield Gas Company* realized £220 5s. per cent.; 25 £10 fully-paid new 1885 shares in the *Great Grimsby Gas Company* produced £16 10s. each; and six £15 shares (£1 10s. paid) in the *Dronfield Gas and Coal Company* changed hands at £1 5s. apiece.——On the same day at Boston, eleven old £10 shares in the *Boston Gas Company* sold for £10 7s. 6d. each; and six new £10 shares for £14 7s. 6d. each. Four £20 shares in the *Grantham Gas Company* fetched £40 apiece.——At Ramsbottom, last Wednesday, Mr. T. Hamer offered for sale £250 consolidated "B" stock in the *Farnworth and Kearsley Gas Company*, and 10 perpetual gas annuities of £1 1s. 5½d., payable by the *Bolton Corporation*. The former realized £360; and the annuities sold at £32 5s. each.

Exhibitions of Gas Appliances.—A joint exhibition of gas appliances has lately been held in the Reform Club, Heywood, by Messrs. Richmond and Co., Messrs. J. Wright and Co., and Messrs. C. Wilson and Sons. Cookery lectures were delivered by Miss Owen. ——Under the auspices of the Heckmondwike Gas Company, the last-named firm opened an exhibition of their specialities in the Wesleyan School in that town on Monday last week; Miss A. Smith giving cookery lectures in conjunction therewith.——A similar exhibition has lately been held in the Pump Room, Tunbridge Wells, by Messrs. Richmond and Co., under the auspices of the Gas Company; Miss Leng giving lectures and demonstrations.——The Davis Gas-Stove Company, Limited, held exhibitions last week at Sunbury-on-Thames and Herne Bay; Miss Nelson lecturing at the former, and Miss Johnston at the latter place.——Messrs. W. Parkinson and Co.'s recent exhibitions have been at Luton and Berkhampstead; Miss Thwaites lecturing at each place twice daily.

Mossley Corporation Gas Supply.—At the last meeting of the Mossley Town Council, the report of the Auditors on the gas-works accounts for the year ending the 25th of March last was presented. They stated that the revenue account showed a net loss of £12 12s. 11d., against one for the year ended March 25, 1892, of £272 8s. 7d.—an improvement of £259 15s. 8d., arising from a decrease in the expenditure of £1568 0s. 6d., less a decrease in the income of £1285 12s., and an increase on the interest on loans and sinking fund instalments of £22 9s. 10d. Mr. H. Jones criticized the administration of the undertaking, and alleged that the original purchase was unwise. Last year the cost price of gas per 1000 cubic feet was 2s. 3·262d.; and this year it was 2s. 1·414d. But last year the interest on loans and sinking fund instalments amounted to 10·226d.; while this year they came to 11·445d. per 1000 feet. This only confirmed the statement he had previously made, that the works were purchased at sadly too high a price; and it appeared to him they would not be able for many years, if at any future time, to produce gas at an equitable, fair, and reasonable rate in comparison with other boroughs. The Chairman of the Gas Committee (Alderman R. S. Buckley) said he was prepared to challenge Mr. Jones, and show that the borough was producing gas at a cost under the average cost of other towns in Lancashire, Yorkshire, and Cheshire; and, if this was the case, they had nothing to grumble about. The Mayor (Mr. H. T. Clementson) added some words in defence of Mr. R. Merrill, the Manager of the gas-works; and the report was adopted.

THE LONDON COUNTY COUNCIL AND THE WATER SUPPLY OF THE METROPOLIS.

The Flow of the River Thames—Water Legislation.

Among the reports presented to the London County Council at their meeting last Tuesday was one by the Special Water Committee, dealing with the above subjects.

With regard to the first-named matter, the Committee consider it important that a careful record should be kept of the flow of the river, and that the series of tabulated forms and diagrams, comprising the years 1883 to 1891 inclusive, which has already been commenced by the Engineer (Mr. A. R. Binnie, M.Inst.C.E.), should be continued in the same form. The Thames Conservators have furnished the Council with copies of their records of the detailed flow of the river during the year 1892; and, with a view to maintain the continuity, the Committee have authorized the Engineer to apply for the similar records for the current year up to date. They have also instructed him to take steps for obtaining returns of the average rainfall of the Thames Valley.

The other subject dealt with by the Committee—that of the projects of the Council in regard to water legislation for the Metropolis—is of sufficient importance to justify the reproduction in full of this portion of the report. It is as follows: "The report of the Royal Commission on the Metropolitan Water Supply has not yet been issued; and the date of its appearance is, of course, uncertain. Meantime, there is, in our opinion, a general expectation that the Council will not allow the powers for promoting legislation conferred upon it by the London Water Act, 1892, to slumber. A comprehensive scheme dealing with the whole of the Metropolitan supply is obviously not yet practicable, though we are using every effort to collect the materials for such a scheme. Pending the formulation of a general plan, however, it is desirable that precautions should be taken against any increase in the difficulties which it may meet. The most serious of these, perhaps, would be any substantial enlargement of the capital value of the Companies or of their means of supply. This consideration is of imminent importance, in view of the fact, which is all but undisputed, that the existing resources of the Companies are strained to the utmost. In other words, the constantly growing demand of the Metropolis for an increased supply of water renders the provision of an additional source, from some quarter or other, almost immediately necessary. To provide this, it is practically certain that, in the ordinary course of things, the Companies, or some of them, would ask Parliament for additional powers; and such a demand, considering the necessities of the case, might be difficult to resist. In our opinion, therefore, this demand should be anticipated by the Council's own action under the statutory powers which it has recently obtained. We are giving very careful consideration to the details of this question, upon which we hope to present a further report. The present is a preliminary recommendation, in obedience to the Standing Order which directs that schemes requiring parliamentary authority shall be presented to the Council not later than the first meeting in June. The report of the Royal Commission (if issued), and the results of the inquiries we are making, may, of course, render modifications necessary hereafter; but, in the meantime, we are strongly of opinion that the Council should be prepared for every emergency. We therefore recommend that the Parliamentary Committee be instructed to prepare a Bill for introduction in the session of 1894, to empower the Council to provide a supplementary supply of water for the County of London."

The Bolton Gas Undertaking.—At a meeting of the Bolton Gas and Lighting Committee on the 12th inst., the revenue reserve fund account was submitted. It showed a proposed transference of £7500 to the reserve fund, and the appropriation of £14,546 in aid of the rates.

Malta and Mediterranean Gas Company, Limited.—The report of the Directors of this Company for the year ending March 31 last has been issued. It states that there has been a satisfactory increase in the sale of gas at all the stations; and at Malta the price has been further reduced. The loan capital has been increased by the issue of additional debentures to the extent of £3000. This issue was necessary in order to meet the outlay for works—now in progress—connecting the two Malta stations, and concentrating the manufacture of gas at Valletta. From this arrangement considerable economy is expected. The revenue account shows that the gross receipts amounted to £35,225; and, deducting expenditure, a balance remained of £10,112. The Directors recommend, after payment of the usual dividends upon the preference capital, that a dividend of 4 per cent. upon the ordinary capital be declared; making, with the interim dividend of 2 per cent. paid in December last, 6 per cent. for the year, and leaving the sum of £1421 to be carried forward to the next account.

The Barnet Gas and Water Company and their Brick-Making Contractor.—In the Queen's Bench Division of the High Court of Justice last Wednesday and Thursday, Mr. Justice Wright was occupied in trying, without a jury, an action brought by the Barnet Gas and Water Company against Mr. Joseph South, of Edmonton, for damages for breach of contract entered into for the manufacture of bricks. The defendant had been paid a sum of £195 15s. on account of bricks made and to be made; but as the plaintiffs' Engineer (Mr. T. H. Martin, Assoc.M.Inst.C.E.) refused to certify for certain bricks delivered, which he said were either improperly burnt or absolutely worthless, proceedings were taken to recover the amount, with damages. The defence amounted to a denial of the plaintiffs' allegations, and a charge against them of neglecting to furnish the necessary chalk for carrying out the contract. Defendant counter-claimed £180, for loss of profit, and for the detention by the plaintiffs of a quantity of his plant. His Lordship, having heard a considerable number of witnesses, said it was impossible for him, in the conflict on the facts, to arrive at a decision without having a report from some independent person who had inspected the brickfield. At present it seemed to him there had been perjury on one side or the other. Counsel for the respective parties agreeing, his Lordship's suggestion was acted upon.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Town Council of Edinburgh last Tuesday approved of the minutes of the special meeting held on April 21, at which it was resolved that they should retain the working of the electric lighting undertaking in their own hands. The resolution now becomes final; and the next step will be to proceed with the collection of information as to how they are to proceed. This seems strange, because the natural way should have been that the Council should have mastered the subject before making up their mind. This, however, they did not do; they made up their mind first, and are now about to inquire. I know of one member who voted twice in favour of the Council doing the work before he so much as read the Provisional Order. "The man in the street" seems to be the authority they have elected to rely upon. Bailie Walcot, speaking against the proposal that the Council should retain the work, said "he had conversed with a good many men both in and out of London; and he found, without exception, that they were of his opinion." The Lord Provost, on the other side, said "he had been in London, and had spoken to several gentlemen; and they all said the town should take the lighting over." Let us hope that so much of "the blind leading the blind" may not lead to their landing the venture in a ditch. Two things transpired during the discussion which are worthy of notice. One was a reference by Mr. J. A. Robertson to inquiries which he made of two of the local electric lighting companies as to the terms upon which they would undertake the lighting. Only one of the companies gave him what can be termed a straightforward answer; and he declared that, if the companies could not undertake the lighting of the city on better terms than had been stated, he would support the proposal that the Council should provide the light. The other statement was contained in a violent speech by Mr. J. H. Waterston, a labour representative, in which, while supporting the Lord Provost, he referred to the gas transfer in language—characteristic of his class—to the effect that "he would be no party to another robbery if he could avoid it." If Mr. Waterston had read the remarks of Mr. Kinloch Anderson at the previous meeting of the Council, as to the benefits which have been already conferred on the community by the Gas Commissioners, he must have a curious mind if he still regards the gas transfer as a robbery.

Mr. Robertson's inquiries of electric lighting companies—referred to above—are interesting as showing how little faith the promoters of electric lighting have in their own pet business. The questions he put were: (1) What length of lease do you propose? (2) What rate per unit to start with do you propose to charge, and by how much do you propose to reduce that rate, say, in the second, fourth, and sixth years of the lease; or, say you start with so much per unit for 40,000, or under, lights, how much will you reduce for every 10,000 additional lights? (3) Upon what terms will you give the city the option of acquiring your plant, business, &c., at the end of the lease? (4) What proposal have you to make with reference to the streets and the laying of the mains? The Scottish Electric Supply Company sent him, in reply, a copy of correspondence which passed between the representatives of the Company and the Corporation in 1889 and 1890, together with the draft of the Provisional Order they were then applying for, the draft of the clauses offered to the Corporation for adjustment, &c. The Directors felt that it would be impossible to give any figure as to cost just now, without any experience of the work. Some 6d. or 6½d. per unit, they said, was talked of; but they did not commit themselves to a figure on that point. The Edinburgh Electric Supply Corporation sent him a memorandum containing possible terms on which an agreement might be based. These were: (1) That an agreement be entered into whereby they be authorized to expend £200,000 on the plant, mains, &c., redeemable at the option of the Town Council after the expiry of 10 years at a premium of 10 per cent.; after 15 years, at 5 per cent.; and after 20 years, at par. (2) When more capital is required to meet extensions, that a fresh agreement be entered into. (3) The Company undertake to charge not more than the following: Up to 20 units, 13s. 4d.; and for supply over and above that amount, 7d. per Board of Trade unit—this charge being 1d. less than the maximum allowed by the Board of Trade, and the same as the rate now charged by the Corporation of Glasgow. (4) They undertake that after 7 per cent. has been paid to the shareholders, one-half of the surplus profits will be applied in reduction of rates, the other half to belong to the shareholders. (5) They agree to consult the Town Council before laying mains in any of the streets outside those named in the compulsory area. A table of rebates to large consumers showed that the rate would be 7d. per unit under 3000 units, with reductions up to 16 per cent. for over 60,000 units.

On Friday evening of last week, the employees at the Kirkcaldy Gas-Works met and presented Mr. James MacPherson, the Assistant Manager, who has been appointed Manager of the Cupar Gas-Works, with a marble time-piece, bearing a suitable inscription, as a token of their respect and esteem for him, and their regret at his leaving them. Mr. MacPherson acknowledged the gift in appropriate terms, and then entertained the company to supper. Mr. MacPherson is a nephew of Mr. A. MacPherson, Manager of the Kirkcaldy works. He studied chemistry, natural philosophy, and engineering at St. Andrews University and Dundee University College; and he holds certificates for magnetism and electricity, as well as the certificate of the City and Guilds of London Institute for knowledge in gas manufacture. These qualifications, taken along with those possessed by Mr. Thomson, who has just been appointed Manager of the Broughty Ferry Corporation Gas-Works, give some indication of the high quality of person who is now going in for the management of gas-works, and give also good hope for the profession in days to come. The gas-works at Kirkcaldy must be a sort of seminary for gas managers; as this is the second appointment which has been filled from the ranks of the employees there within a short space of time. In this connection, I would venture to repeat what I once wrote before, that I cannot conceive of any better method of disposing of the Murdoch Memorial Fund than n instituting an examination in gas manufacture, under the auspices of the North British Association of Gas Managers, and giving awards in honours to the students who pass, and in money to the managers who instruct them. Such a scheme I regard as infinitely superior to either founding a bursary for the sons of gas managers, which could only be held by one at a time, or establishing an experimental station, which might get into the hands of an incapable man, and be of no use to anybody. The advantage of my proposal would be that it would keep both managers and assistants up to date; and while the assistants would get both a practical and a theoretical training, the managers would have some consideration for their trouble in training their assistants—a matter which would not be without value to many managers who are not overpaid.

The annual meeting of the Stonehaven Gas Company has been held; and the Directors were able to report continued prosperity. The customary dividend of 2s. 6d. per share was paid. An exhibition of gas appliances was held in the town recently; and it is expected that it will result in a considerable demand for gas for cooking and heating.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 19.

Sulphate of Ammonia.—A somewhat better feeling is noticeable, which is not surprising seeing the very small stocks everywhere; and the present decreasing production is rapidly absorbed by the demand. The latter, even if not large, is quite sufficient to prevent any accumulation of stocks. Business is usually very quiet at holiday time; and this will probably be the case next week, unless requirements to complete May engagements keep the market lively. Quotations are still irregular. They range from £11 15s. to £12 at the ports; and it is rumoured that speculators are quoting £11 10s. for June delivery. Nitrate offers freely at 9s. per cwt.

LONDON, *May* 19.

Tar Products.—The market is very stagnant; and little or no new business is being done. Pitch is reported weaker; and, owing to the large quantities of benzol being thrust upon the market by German coke makers, benzols for the moment have merely a nominal value. Manufacturers hope that, with the turn of the holidays, and the lessened production here which is already commencing to be felt, business may improve. The outlook, however, at the moment, is most discouraging. To-day's quotations are: Tar, 12s. Pitch, 23s. 6d. Benzols, nominal, 90's and 50's, 1s. 4½d. Solvent naphtha, 10½d. Toluol, 1s. 4d. Crude benzol naphtha, 30 per cent., 7½d. Creosote, 1d. Creosote salts, 17s. Carbolic acid, 60's, 2s. 4d.; 75's, 2s. 10½d.; crystals, 7½d. Cresol, 1s. 10d. Anthracene, nominal, 30 per cent. "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia looks much better. Business is reported in several quarters at prices ranging from £11 12s. 6d. to £12, less 3¼ per cent.; while £11 10s. is freely offered for forward delivery. The market appears to be entirely devoid of stocks—never more so; and for this cause, if for no other, the value should not recede. Gas liquor, 10-oz., is quoted at 7s. 6d. to 8s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business all through the coal trade of this district continues excessively quiet; and at many of the collieries the Whitsuntide holidays are extending over a longer period than usual. Prior to the holidays, very few of the pits have been working more than three to four days per week; and even with this restricted output, stocks have been accumulating rapidly—many of the collieries not sending away more than half their usual quantities. The competition of surplus supplies upon the market gives a weakening tendency to prices generally. With regard to gas-coal contracts, reductions of 1s. to 1s. 6d. per ton upon the prices obtained last year are now very generally talked of; and where business so far has been done, it would seem to be exceptional where more than 8s. to 8s. 3d. is being got for good screened gas coal at the pit mouth. In the general round coal trade, prices are very irregular; and where anything like quantities are concerned, sellers for the most part do not adhere to their list rates. It is only in special cases where more than 11s. per ton is being got for best Wigan Arley house coal at the pit mouth; with Pemberton four-feet and second qualities of Arley averaging 9s. 6d.; and common house-fire coals, about 7s. 6d. per ton. Lower qualities of round coal for steam and forge purposes are so complete a drug upon the market, that any fixed quotations are of very little value, beyond the general statement that they can be bought at from 6s. per ton upwards. The shipping trade remains in a very depressed condition; and ordinary descriptions of steam coal, delivered at the ports on the Mersey, do not average more than 7s. 6d. to 7s. 9d. per ton. The very restricted demand for round coal, and the consequent limited quantity of slack that is now being screened, is necessarily producing a scarcity of engine classes of fuel; and for these there is an increasing pressure of demand, with a hardening tendency in prices. In many cases, colliery proprietors are now offering through and through coal as a substitute for ordinary engine fuel, at very low figures. This, with burgy, can be bought at 6s. to 6s. 6d.; with best slack fetching 5s. 3d. to 5s. 9d.; and ordinary qualities, 4s. to 4s. 6d. per ton.

Northern Coal Trade.—There is a fair demand for coal in the North; and the holiday interruption of the output will enable that demand to be continued for some time. Best Northumbrian steam coals are now quoted about 8s. 9d.; second qualities, 8s. to 8s. 3d.; and small steam coals, 3s. 6d. to 3s. 9d. per ton f.o.b. Most of the collieries have plenty of work; and there is now a full demand for shipment to the Baltic. Gas coal is nearly at the lowest period of demand for local use, and the shipments are increasing; so that there is a possibility of an early improvement in the requirements. The general price for best Durham gas coals varies from 6s. to 6s. 6d. per ton; but one or two collieries, which are exceptionally placed, ask 7s. per ton. There is little or no alteration in the price of smithy coal—

it continues in demand, at relatively good prices. Coke is rather steady, with a better demand; the lower prices for its carriage to the north-western furnaces having decided one or two users to increase their production of iron, and necessarily their consumption of coke. The price varies from 13s. to 14s. per ton f.o.b. for shipping qualities. Gas coke is not quite so plentiful; the production having been reduced, whilst the shipments are rather higher. At Darlington, a slight reduction in the retail price is noted.

Scotch Coal Trade.—The coal market in Scotland continues in a state of great depression. Steam, splint, and main coal are having a very poor outlet; and much idle time is being experienced at all collieries producing those qualities, which leads to easier prices. A further reduction of 6d. per day in miners' wages, to take effect from Monday, has been resolved upon by the masters in the West of Scotland. In the gas coal trade, buyers are having the best of the contracts which are being made. The prices quoted are: Main, 5s. 6d. to 5s. 9d.; ell, 6s. 9d. to 7s.; splint, 6s. to 6s. 3d.; and steam, 7s. 9d. to 8s. per ton f.o.b. Glasgow. Shipments of coal for the week amounted to 136,686 tons—a decrease of 15,953 tons, as compared with the preceding six days, and of 46,042 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 2,250,435 tons—a decrease of 221,796 tons, as compared with the same period of last year.

Water-Works Extensions at Southampton.—An important report has been submitted to the Works Committee of the Southampton Corporation by the Water Engineer (Mr. W. Matthews), in which he advises that an additional pumping-engine and engine-house be erected at the Otterbourne station, and that more headings be driven. Some other important recommendations are made as to the renewal of mains upon a regular system, by which a large ultimate expense will be avoided, and money saved at present. The estimated cost of the whole scheme is £10,000.

Adoption of Prepayment Meters at Sleaford.—The Sleaford Gas Company, Limited, have decided to adopt the system of prepayment meters for cottage property; and we learn from a circular issued by the Manager (Mr. H. Wimhurst) that the Company are prepared to furnish any cottage with gas-fittings for one light each in front and back rooms, and a boiling-stove for kettles and saucepans, together with a penny-in-the-slot meter, at a charge of 10d. per 1000 cubic feet above the current price of gas—the pence dropped into the meter covering the whole cost of gas, use of fittings, and meter-rent.

Extensions at the Bolton Corporation Water-Works.—The new reservoir constructed by the Bolton Corporation at High Rid has just been brought into use. The work has been in progress since 1889; but a good deal of time was lost by the original contractor getting into financial difficulties. The land occupied by the reservoir is 32 acres; the surface area at top-water level being 24¼ acres. The Engineer (Mr. R. H. Swindlehurst) estimates the holding capacity at from 120 to 130 million gallons. The cost of the work is put down at £27,288. The filter-beds adjoining were completed in October, 1890, and are three in number, having a total surface area of 3658 square yards. Their cost was £7794.

The Barnsley Corporation Water Engineer.—The Water Engineer of the Barnsley Corporation (Mr. Taylor) has had his salary advanced by £50 per annum. Mr. Taylor took charge of the works in 1881, since which time the population has increased from 50,000 to 70,000, and the daily consumption of water from 313,000 to 547,000 gallons. Owing to a great extent to his economy, the consumption has been reduced from 18 to 11 gallons per head per day; and through this the Corporation have been enabled, at all events for the present, to escape the necessity of entering upon further expenditure in extending the works. In 1881 there was a loss on the department; but now the Water Committee are able to show a balance on the right side.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 945.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	17—18	..	5 16 8
100,000	10	"	7½	Do. 7 p. c.	10	12—13	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12	..	13 6 8
200,000	5	12 May	6½	Bombay, Limited	5	5½—6⁵/₈	..	5 8 4
40,000	5	"	6½	Do. New	4	3⅝—4¼	..	6 2 6
380,000	Stck.	24 Feb.	11⅝	Brentford Consolidated	100	210—220	..	5 4 7
180,000	"	"	8½	Do. New	100	168—173	..	4 18 3
220,000	20	15 Mar.	11⅝	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	104—107	..	4 13 5
320,000	20	13 Apl.	11½	British	20	42—44	..	5 4 7
50,000	10	15 Mar.	11⅝	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14¼—15¼	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	5½—6¼	..	— —
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	97—100	..	6 0 0
150,000	20	24 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	243—248	..	5 0 10
165,000	"	"	9½	Do. New do.	100	182—187	..	5 1 7
160,762	"	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	127—132	..	3 8 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited	100	234—239	..	5 8 9
200,000	"	"	10	Do. 7 p. c. Pref	100	192—197	..	5 1 6
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	187—192	..	5 4 2
486,090	10	27 Jan.	10	European, Limited	10	21⅛—22½	..	4 8 11
354,060	10	"	10	Do. Partly paid	7½	15—16	..	13 9
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	217—222	−1½	5 8 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	95—99	..	4 0 10
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	263—268	..	3 14 7
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	170—175	..	4 5 8
1,300,000	"	"	7	Do. H, 7 p. c. max	100	169—174	..	4 0 5
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	260—265	..	3 15 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	156—160	..	3 15 0
1,061,150	"	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	124—128	..	3 2 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	130—134	..	3 7 2
908,000	"	"	6	Do. 6 p. c. do	100	169—173	..	4 9 4
3,800,000	Stck.	12 May	12	Imperial Continental	100	218—222[x]	−4½	5 8 1
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	4 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	102—104	..	4 16 2
541,920	20	16 Nov.	5	Monte Video, Limited	20	13—14	..	7 2 10
150,000	5	30 Nov.	10	Oriental, Limited	5	7¾—8¼	..	6 1 2
60,000	5	29 Mar.	7	Ottoman, Limited	5	4—4⅜	..	7 7 4
166,870	10	—	2	Pará Limited	10	1⅞—2¼	..	—
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	28 Apl.	5	San Paulo, Limited	10	8½—9⅜	..	5 5 3
500,000	Stck.	24 Feb.	15⅝	South Metropolitan, A Stock	100	294—299	..	5 3 8
1,350,000	"	"	12	Do. B do.	100	244—248	..	4 16 9
230,000	"	"	13	Do. C do.	100	245—255	..	5 1 11
750,000	"	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	15 Mar.	11⅝	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	265—270	..	3 14 1
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	210—214	−2	3 14 9
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	142—145	..	3 2 1
700,000	50	15 Dec.	8½	Grand Junction	50	111—114	..	3 14 7
708,000	Stck.	10 Feb.	11	Kent	100	280—285	..	3 17 2
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	243—248	..	4 16 7
406,200	100	"	7½	Do. 7½ p. c. max.	100	199—204	..	3 14 0
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129—132	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	329—334	..	3 12 8
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	..	2 18 5
902,300	Stck.	15 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	165—170	..	3 16 5
126,500	100	"	6½	Do. D 7½ p. c. do.	100	145—150	..	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	262—267	..	3 14 11

[x] Ex Div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

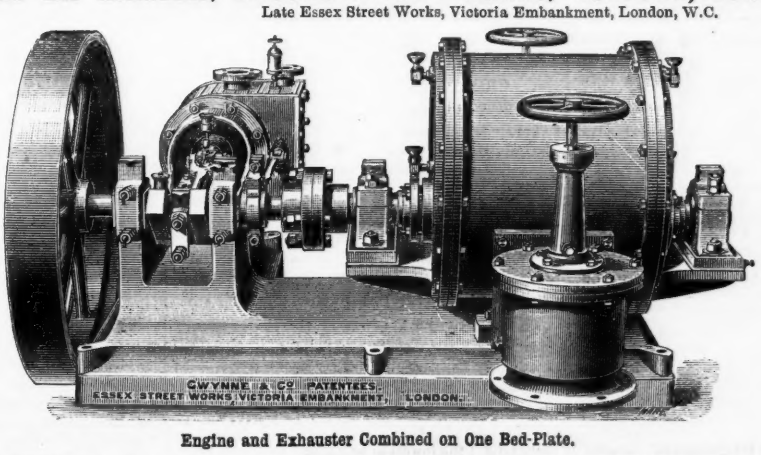
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's) Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

WANTED, immediately, a good Main and SERVICE LAYER.
Forward testimonials to No. 2233, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Young Man as Meter INSPECTOR. State lowest wages and experience.
Forward testimonials to No. 2234, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a first-class Traveller for the English Gas Coal Trade in the Midlands. Liberal terms to one with good connection.
Address No. 2235, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLERS or Agents Wanted, on Commission, with first-class connection among Gas Companies in the South, Midlands, and North of England. Liberal Terms.
Address No. 2236, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORTHING GAS COMPANY.

WANTED, by this Company, a thoroughly qualified man as METER INSPECTOR and REPAIRER. Wages 30s.
Applications, accompanied by three testimonials of recent date, to be sent to the undersigned on or before Thursday, the 1st day of June next.
W. A. WALKER, Manager.

WANTED, immediately, by the Llan- gollen Gas Company, Limited, a WORKING MANAGER. Must have a thorough practical knowledge of Gas Making and its Distribution. One who is a Fitter preferred. Make of Gas, 4 millions a year. House, Light, and Fire provided.
Applications, with testimonials, stating wages required, to be sent in before the 25th inst., and to be addressed to Mr. HARVEY BIRCH, Cherry Tree, LLANGOLLEN.

MERTHYR TYDFIL GAS COMPANY.

WANTED, a young Man, as Assistant CLERK. Must be experienced in the Accounts of a Gas Office.
Applications, in own writing, stating age, experience, and particulars of last employment, and enclosing *copies only* of three recent testimonials, to be endorsed "Assistant Clerk," and addressed to the undersigned not later than Tuesday, the 30th inst. Salary £78 per annum.
JOHN L. COCKER, Manager and Secretary.
Gas Offices, Gas-Works, Merthyr Tydfil, Glamorganshire, May 13, 1893.

WANTED, one of Gwynne and Co.'s GAS EXHAUSTERS. Engine 15 inches diameter, by 20-inch Stroke. Must be in thorough good order.
Address the BRYMBO STEEL COMPANY, LIMITED, near WREXHAM.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

WANTED, 5000 cubic feet per hour Combined ENGINE and EXHAUSTER. State condition and lowest price.
Address No. 2232, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Station Meter, in Circular Case, with Bye-Pass, &c., complete, to pass 9000 cubic feet per hour.
Apply to G. E. SAVILLE, Gas-Works, TODMORDEN.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

FOR SALE—Four Purifiers, with Valves, Connections, and Lifting Gear.
Dimensions—(1) 8 ft. by 4 ft. and 3 ft. 6 in. deep.
(2) 8 ft. by 4 ft. and 3 ft. 6 in. deep.
(3) 7 ft. by 3 ft. 6 in. and 3 ft. deep.
(4) 7 ft. by 3 ft. 6 in. and 3 ft. deep.
Apply to the MANAGER, Gas-Works, Maldon, ESSEX.

FOR SALE—(1) Combined Engine and EXHAUSTER, with Compensating Hydraulic Governor (Laidlaw); passes 7500 cubic feet per hour. (2) STATION GOVERNOR (Milne); 8-in. Connections.
The above are being displaced, in consequence of extensions, and can be seen at the Gas-Works, Portobello, N.B.
DAVID VASS, Manager and Secretary.

GREAT WIGSTON GAS COMPANY.

TO CONTRACTORS, IRONFOUNDERS, ETC.

THE Directors of the above Company are prepared to receive TENDERS for the delivery and laying complete of about 1620 yards of 15-inch CAST-IRON SOCKET AND SPIGOT PIPES.
For Specification Forms of same, apply at once to the undersigned.
JOHN A. HARRIS, Engineer and Manager.

GLASGOW CORPORATION GAS.

TENDERS FOR METERS.

THE Gas Corporation of Glasgow invite TENDERS for the supply of such METERS (Dry and Wet) as they may require for Twelve Months from the 1st of June next.
Forms of Tender may be had on application to the Manager, at the Gas Office, 45, John Street, Glasgow; and sealed Offers, marked "Tender for Meters," to be addressed to and lodged with the Subscriber on or before Tuesday, the 6th prox.
The Corporation do not bind themselves to accept the lowest or any offer.
J. D. MARWICK, Town Clerk.
City Chambers, George Square, Glasgow, May 15, 1893.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA, SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

LIQUOR and Tar wanted. BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the Sutton-in- Ashfield Local Board are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1, 1893, to June 30, 1894.
Particulars may be obtained on application to the Manager, at the Gas-Works, Sutton-in-Ashfield, Notts.
Tenders, stating price per ton of 20 cwt. at the Works, or at Sutton-in-Ashfield Railway Station, to be addressed to the Clerk to the Local Board, Local Board Offices, Sutton-in-Ashfield, and marked "Tender for Tar and Liquor," so as to arrive not later than Tuesday, the 30th day of May, 1893.
By order,
G. H. HIBBERT, Clerk to the Committee.
Local Board Offices, Sutton-in-Ashfield, Notts.

SUTTON-IN-ASHFIELD URBAN SANITARY DISTRICT.

EXTENSION OF GAS-WORKS.

THE Sutton-in-Ashfield Local Board invite TENDERS for the execution of the following WORKS:—
Excavating for, and the erection of, a BRICK TANK, 74 feet in diameter and 18 feet deep.
The erection of a COLUMNLESS GASHOLDER.
The erection of a set of Four PURIFIERS, 23 ft. by 10 ft., with Valves, Connections, Lifting Gear, &c., complete.
Plans, Specifications, Quantities, and Form of Tender will be sent by post on application to the Engineer, Mr. C. E. Jones, Chesterfield, as follows: Excavating and Erecting the Tank, &c., One Guinea; Four Purifiers, Connections, &c., One Guinea; and for the Gasholder, on payment of a fee of 7s. 6d. These Fees will be returned to persons *bond fide* tendering.
Tenders, sealed and endorsed "Tenders for Gas-Works," should be sent to the Manager of the Gas-Works, Local Board Offices, Sutton-in-Ashfield, on or before Monday, the 29th inst.; and the Local Board do not bind themselves to accept the lowest or any tender.
G. H. HIBBERT, Clerk to the said Local Board.
Sutton-in-Ashfield, May 5, 1893.

SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

OWING to making Extensions at the above Works, OFFERS are invited for the SALE of the following PLANT:—
One GASHOLDER, 30 feet diameter by 12 feet deep, with Guides, in good order. The same may be seen in use.
12 in. by 12 in. □ HYDRAULIC MAIN for 30 Mouthpieces, DIP and BRIDGE PIPES, &c.
Offers to be sent in to A. CLARKE, Gas-Works, Sutton-in-Ashfield, NOTTS.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of 4000 tons of GAS COAL, to be delivered during the year ending June 30, 1894.

Sealed tenders to be sent in to the Chairman of the Gas Committee, on or before June 3, endorsed "Tender for Coal."

Any further particulars can be had on application to me.

J. B. FENWICK,
Manager.

Gas and Water Office, Retford,
May 18, 1893.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the Year ending June 30, 1894.

Tenders to be sent in to the Chairman of the Committee, endorsed "Tar" or "Liquor."

Further particulars may be had from the undersigned.

J. B. FENWICK,
Manager.

Gas and Water Office, Retford,
May 18, 1893.

TENDERS FOR GAS COAL AND CANNEL.

THE Directors of the Stretford Gas Company invite TENDERS for the supply of CANNEL and best screened GAS COAL, to be delivered during the next One or Two Years, in monthly quantities as may be required.

Sealed tenders to be sent to the Chairman of the Company not later than June 2, 1893, endorsed "Tender for Coal," or "Cannel."

The lowest or any tender not necessarily accepted.

By order of the Board,
BENJAMIN HAYNES,
Secretary.

Stretford, near Manchester.

THE Directors of the Stretford Gas Company are prepared to receive TENDERS for the supply of the following MATERIALS in such quantities as may be required during a period of One, Two, or Three Years following the acceptance of tender:—

1. Gas-Meters.
2. Brass Main Taps and Keys.
3. Wrought-Iron Tubes and Fittings.
4. Stationery and Printing.
5. Lime.
6. Retort Mouthpieces, Door-Frames, Special Bends, &c.
7. Oils and Cotton Waste.

Further information may be obtained upon application to the Secretary, Gas-Works, Stretford.

Sealed tenders, endorsed "Tender for Miscellaneous Goods," together with Sample of Goods offered, addressed to the Chairman of the Company, Stretford, must be delivered not later than the 2nd of June, 1893.

The lowest or any tender not necessarily accepted.

By order of the Board,
BENJAMIN HAYNES,
Secretary.

Stretford, near Manchester.

OLDBURY LOCAL BOARD OF HEALTH.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of 6500 tons, or thereabouts, of GAS COAL for delivery during the Year ending the 30th of June, 1894, in such quantities and at such times as ordered, carriage free, at the Oldbury Basin of the Great Western Railway Company.

The Coal must be of first-class quality, freshly wrought, and as free as possible from Bats, Pyrites, and other foreign matter.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Coal," to be delivered to the undersigned not later than Saturday, June 10 next.

The Gas Committee do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order.
A. COOKE,
General Manager.

Gas-Works, Oldbury, May 17, 1893.

TO CHEMICAL MANUFACTURERS AND OTHERS.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Gravesend and Milton Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR of the Company from the 24th day of June, 1893.

The Contract will terminate on the 23rd day of June, 1894.

The Purchaser will be required to sign a Contract, a copy of which can be seen at my Offices.

The Tar and Liquor will be delivered free into the Purchaser's Barges alongside the Company's Works, which abut on the Thames and Medway Canal above the Lock.

The Purchaser must pay any Canal or other Dues.

Tenders must quote for Tar at per gallon, and for Liquor at per ounce of strength per butt of 108 gallons. Twaddel's test (at 60° Fahr.) will be strictly observed.

The Directors do not guarantee any specific quantity of Tar or Liquor; but there will probably be about from 80,000 to 100,000 gallons of Tar.

Tenders, marked outside "Tenders for Tar and Liquor," sealed and addressed to the Chairman and Directors, Gas Company's Offices, 9, Berkley Crescent, Gravesend, must reach the Offices not later than Tuesday, the 30th day of May inst.

The Directors do not bind themselves to accept the highest or any tender.

Dated this 13th day of May, 1893.

CHAS. R. GRAMSHAW,
Secretary.

TENDERS FOR GAS COAL.

THE Widnes Corporation invite Tenders for the supply of about 15,000 tons of GAS COAL (slack, "through and through," or screened Coal), to be delivered at the Gas-Works, Widnes.

Conditions and Forms of Tender may be obtained from Mr. Carr, Assoc.M.Inst.C.E., Gas Engineer, Widnes.

Tenders, to be addressed to the Chairman of the Gas Committee, endorsed "Gas Coal," and delivered to the undersigned not later than Eleven a.m. on the 6th of June prox.

The lowest or any tender will not necessarily be accepted.

H. S. OPPENHEIM,
Town Clerk.

Town Hall, Widnes,
May 12, 1893.

CAMBRIDGE UNIVERSITY AND TOWN GAS-LIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 20,500 tons of CANNEL, best well-screened GAS COAL, and NUTS, to be delivered between the 1st of July, 1893, and the 30th of June, 1894.

Forms of Tender and Specification may be obtained on application to the undersigned.

Sealed tenders to be sent to the Chairman of the Company not later than the 12th day of June next, endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

By order,
W. DUESBURY,
Manager.

Gas-Works, Cambridge,
May 5, 1893.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for MATERIALS and LABOUR required in the erection of a Bench of 49 Inclined Retorts.

Contract No. 1—Machine-made RETORTS, FIRE-CLAY, BRICKS, &c.
Contract No. 2—IRONWORK and LABOUR, raising Retort-House Roof.
Contract No. 3—IRONWORK and LABOUR, building Benches and setting Retorts.
Contract No. 4—RETORT MOUTHPIECES, with Self-Sealing Lids.
Contract No. 5—COAL and COKE ELEVATORS, CONVEYORS, HOPPERS, SHOOTS, &c.

Drawings may be seen and Copies of Specifications and Tender Forms obtained, on payment of Five Guineas, which will be returned on receipt of a *bond fide* tender, by application to the undersigned.

Sealed tenders, endorsed with Contract number, and addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leigh, not later than Monday, the 29th inst.

The lowest or any tender not necessarily accepted.

ALFRED T. FLETCHER,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
May 17, 1893.

BRADFORD CORPORATION WATER-WORKS.

TO CONTRACTORS.

CONTRACT NO. 1.—GOUTHWAITE RESERVOIR. NIDD VALLEY WORKS.

THE Corporation of Bradford invite TENDERS for the construction, and maintenance for Twelve Months after completion, of a large COMPENSATION RESERVOIR and Works connected therewith at Gouthwaite, situate about 2½ miles from Pateley Bridge.

The Works will comprise:—

1. Masonry Dam, Earth Embankment, Outlet-Valve Towers, Culverts, Bridge of fourteen Spans, Waste Channels, Gauge Basin, and River Walls.
2. The opening and working of Stone Quarry, construction of Tramway Line from Quarry to Embankment, Masonry Bridge, and Works connected therewith.
3. The formation of about 2½ miles of New Roads, including Bridges and Culverts.
4. The erection of about 7½ miles of Boundary and Road Walls, with Entrance Gates and other Works.

The Drawings and Specification of Works may be seen, and Copy of the Specification, with Conditions, Bills of Quantities, and Form of Tender, may be obtained at the Office of Mr. James Watson, M.Inst.C.E., the Corporation Water-Works Engineer, Town Hall, Bradford, on and after Friday, the 12th inst., on payment of Five Guineas, which sum will be returned in full as soon as practicable after the receipt of a *bond fide* Tender, with the Bill of Quantities and Schedule fully priced out.

An Assistant Engineer will meet intending Contractors at Stripe Head Farm, Wath, Pateley Bridge, on Friday, the 19th inst., Wednesday, the 24th inst., Tuesday, the 30th inst., and Friday, the 2nd day of June next, each day at One o'clock p.m., to show them over the Site of the Works, the Shafts sunk on the line of the Embankment, and the Quarry, and to supply any other information required.

Sealed tenders, endorsed "Tender for Gouthwaite Reservoir," to be sent to the Town Clerk at the undernamed Office not later than Thursday, the 8th of June next.

An assurance must be given by each Contractor that he pays to the workmen employed by him not less than the minimum standard rate of wages.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
W. T. M'GOWEN,
Town Clerk.

Town Clerk's Office, Town Hall,
Bradford, May 4, 1893.

Great Wigston Gas Company.

ISSUE OF £2000 NEW ORDINARY STOCK AS ADDITIONAL ORDINARY CAPITAL OF THE COMPANY.

The Directors invite Tenders for £2000 New Ordinary Stock, recently created by the Company under the powers of the Great Wigston Gas Act 1889, and which will be sold in 200 Lots of £10 each.

The purchase-money for each Lot will be payable on the 30th day of June, 1893, and the purchasers will be entitled to share in the profits of the Company from and after that date; but the Stock will carry Dividends at the rate and to the extent of seven-tenths only of the rate of Dividend which shall from time to time be declared in respect of the original Stock of the Company (amounting to £14,000), as provided by Sections 26 and 27 of the said Act. A copy of the Sections referred to is given below.

The Tenders shall state the number of Lots tendered for, and the amount offered for each Lot. The highest bidder shall be the purchaser; but no less price will be accepted than the amount to be stated as the reserved price in a notice to be given by the Company to the Board of Trade, pursuant to the Provisions of the said Act—such reserved price being not less than the nominal value of each Lot. If any offer made by a present Stockholder or Stockholders of the Company be the same in amount as any offer made by any other person, the offer of such Stockholder or Stockholders is entitled to, and will be accepted in, preference.

The Stock will, immediately on payment of the purchase-money, be registered in the names of the applicants or their nominees free of expense.

No greater number of Lots of the present issue will be sold or allotted than will be sufficient, with the premiums, if any, obtained thereon, to raise the sum of £2000.

Tenders sealed up and marked "Tender for New Ordinary Stock" must be sent to the undersigned, the Secretary of the Company, at the Company's Office, Bushloe End, Great Wigston, near Leicester, not later than Four o'clock in the Afternoon of Friday, the 16th day of June, 1893, and may be in the following form, printed copies of which can be obtained on application to the Company's Secretary.

FORM OF TENDER.

I hereby tender for Lots of £10 each of New Ordinary Stock of the Great Wigston Gas Company at the price of for each Lot. And I agree to accept the said Lots or any less number that may be allotted to me, and to pay the purchase-money to the Company's Bankers, Messrs. Pare's Leicestershire Banking Company, Limited, Leicester, on or before the 30th day of June, 1893.

Dated this day of 1893.

(Name).....

(Address).....

(Description).....

To the Great Wigston Gas Company.

Letters of allotment of Shares will be sent by Post on or before the 20th day of June, 1893, to applicants whose offers are accepted.

By order,
IDDO SAMPSON,
Secretary.

Gas Office, Bushloe End, Great Wigston,
May 17, 1893.

Sec. 26.—"Except as by this Act provided, the "profits of the Company to be divided among the "Shareholders in any year shall not exceed the "following rates (which are in this Act referred to as "the standard rates of dividend)—that is to say:

"On the original stock the rate of £10 in respect "of every £100 of such stock and on the additional "capital to be raised under the powers of this Act "the rate of £7 in respect of every £100 actually "paid up of such capital as shall be issued as "ordinary capital and the rate of £6 in respect of "every £100 actually paid up of such capital as "may be issued as preference capital."

Sec. 27.—"In case in any half year the funds of the "Company applicable to dividend shall be insufficient "to pay the full amount of dividend at the prescribed "maximum rate on each class of ordinary stock or "shares in the capital of the Company a proportionate "reduction shall be made in the dividends of each "class."

TAUNTON GASLIGHT AND COKE COMPANY.

THE Directors are prepared to receive TENDERS for the supply of COAL over a Year from the 1st day of July next.

Particulars may be obtained from the Secretary, to whom sealed offers to supply (endorsed "Tender for Coals") should be sent not later than the 31st of May next.

By order,
A. EDWARDS,
Secretary and Manager.

May 12, 1893.

MIRFIELD GAS COMPANY.

THE Directors invite alternative Tenders for a TWO-LIFT GASHOLDER, 100 feet diameter by 25 feet deep, to be erected at their Works, Ravensthorpe, with and without Columns, Girders, and Stays.

Tenders (endorsed), accompanied with Plans and Specifications, to be sent in not later than Monday, the 29th inst., addressed to

SAML. DAY,
Secretary.

Gas Company's Offices,
Ravensthorpe, *viâ* Dewsbury,
May 17, 1893.

TO TAR DISTILLERS.

THE Directors of the Whitehaven United Gas Company, Limited, invite TENDERS for the purchase of surplus TAR produced at their Works for a term of One Year from the 1st day of July, 1893.

Conditions of Tender and further Particulars may be had from the undersigned, to whom the tenders must be delivered not later than Friday, the 2nd day of June next.

The Directors do not bind themselves to accept the highest or any tender.

By order,
S. STUDHOLME,
Secretary and Manager.

TENDERS FOR GAS COAL.

THE Directors of the Victoria Newmarket Gaslight and Coke Company, Limited, invite TENDERS for the supply of 4500 tons of best screened GAS COAL during the ensuing Twelve Months ending June 30, 1894.

Tenders, stating price per ton, delivered free at Newmarket Station as required, to be sent to the undersigned, on or before the 2nd of June, 1893, from whom any further particulars may be obtained.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
J. H. TROUGHTON,
Manager and Secretary.

Gas-Works, Newmarket,
May 19, 1893.

BUXTON LOCAL BOARD.

TENDERS FOR TAR AND LIQUOR.

THE Buxton Local Board invite TENDERS for the purchase of the surplus TAR and LIQUOR produced at their Works in Ashwood Dale, for One, Two, or Three Years, commencing from the 30th of June next.

Further Particulars and Forms of Tender to be obtained of Mr. G. Smedley, Gas Office, Buxton.

Tenders, endorsed "Tender for Tar and Liquor," to be addressed to the Chairman of the Gas Committee, and delivered not later than Twelve Noon on the 3rd of June.

The Board do not bind themselves to accept the highest or any tender.

By order,
JOSIAH TAYLOR,
Clerk.

Town Hall, Buxton,
May 20, 1893.

SHREWSBURY GASLIGHT COMPANY.

DISPOSAL OF SURPLUS TAR.

THE Directors of the above Company are desirous of receiving TENDERS for the purchase of the surplus TAR made at their Works during the Year commencing July 1, 1893.

The estimated quantity for disposal is about 950 tons per Annum.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent in to the undersigned not later than the 17th day of June, 1893.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1893.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of about 13,000 tons of GAS COALS, and about 1000 tons of good ENGLISH CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1893, and ending June 30, 1894.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 17th day of June, 1893.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1893.

TENDERS FOR COAL.

THE Directors of the Derby Gaslight and Coke Company are prepared to receive TENDERS for the supply of 40,000 tons of COAL or NUTS.

Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal," and addressed to the Chairman of the Finance Committee, must be delivered at the Offices of the Company, Friar Gate, on or before Tuesday, the 30th day of May.

RICHARD FISHER,
Secretary.

Gas Office, Derby, May 8, 1893.

BOROUGH OF MANSFIELD.

THE Gas Committee invite Tenders for the supply of 5500 tons of best screened GAS COAL and NUTS, also 500 tons of CANNEL, for use at the Gas-Works, to be supplied for One Year ending May 31, 1893.

Particulars may be obtained from Mr. Hearson, Gas-Works, Mansfield.

Tenders to be sent in on or before the 31st of May, 1893, marked "Tender for Coal," and addressed to

R. J. PARSONS,
Town Clerk.

Mansfield, May 5, 1893.

CHELMSFORD GASLIGHT AND COKE COMPANY.

TENDERS FOR COALS.

THE Directors of this Company invite TENDERS for the supply of GAS COAL COBBLES, or NUTS for One Year; the quantity being about 3500 tons.

The Coals, Cobbles, or Nuts must be the best of their respective kinds, freshly wrought, and to be as free as possible from Sulphur, Bats, Bind, and Dirt.

Sealed tenders, specifying the description of Coals, the Seams and the Pit at which they are raised, and stating price per ton delivered free at the Siding of the Great Eastern Railway Company, Chelmsford, or f.o.b. the Company's Ships in the Tyne or elsewhere, must be delivered not later than May 30.

The Directors reserve to themselves the right to decline the lowest or any tender.

Further Information and Forms of Tender may be obtained of the undersigned on application.

EDMUND G. SMITHARD,
Engineer.

Gas-Works, Chelmsford,
May 15, 1893.

GUILDFORD GASLIGHT AND COKE COMPANY.

TO GAS COAL MERCHANTS.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 16,000 to 18,000 tons of GAS COAL, to be delivered free at Guildford Station during the period of Two Years from July 1, 1893, to June 30, 1895, in such quantities and at such times as required.

The Directors reserve the right to accept the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any tender.

Tenders to state the name of the Coal offered, to be endorsed "Tender for Coal," and to be sent to Mark Smallpeice, Esq., Chairman of the Gas Company, Guildford, on or before Wednesday, May 31, 1893.

By order,
WILLIAM LONGWORTH,
Secretary.

Gas Offices, Guildford,
May 12, 1893.

TO TAR AND LIQUOR DISTILLERS.

THE Directors of the Guildford Gaslight and Coke Company are prepared to receive TENDERS for their surplus TAR and LIQUOR for the Year ending June 30, 1894.

Quantity of Coal and Cannel carbonized, about 9500 tons.

Tenders to state the price per cask of 40 gallons, and in matter of Liquor to state the price per cask of 5° and upwards. Cartage to and from Railway Station, Guildford, by Gas Company free.

Tenders, properly endorsed, and addressed to the Chairman of Directors, Gas Company, Guildford, must be delivered on or before Wednesday, May 31, 1893.

By order,
WILLIAM LONGWORTH,
Secretary.

Gas Offices, Guildford,
May 11, 1893.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 18,000 tons of GAS COAL for One year, from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price delivered both in Vessel, and at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 5th day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 11, 1893.

TO COLLIERY OWNERS.

THE Gas Committee of the Corporation of Blackpool are prepared to receive TENDERS for the supply of COAL and CANNEL for the next Twelve Months.

Forms of Tender may be had from the undersigned.

Tenders, endorsed outside, and addressed to the Chairman of the Gas Committee, to be sent in by the 27th day of May.

(Signed) JOHN CHEW,
Engineer.

Gas Office, Blackpool,
May 13, 1893.

BROADSTAIRS GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply of 2000 tons of good screened GAS COAL, delivered at Broadstairs Station or into Carts at Broadstairs Harbour, in such quantities as the Manager may require between August, 1893, and July, 1894.

Tenders to be sent in not later than Monday, June 5, 1893, addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

Full Particulars can be obtained on application to the undersigned.

W. J. LATCHFORD,
Secretary and Manager.

Broadstairs, May 8, 1893.

COUNTY BOROUGH OF BURNLEY.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for the supply of the CANNEL COAL required by them during the Twelve Months ending May 31, 1894.

Approximate quantity required, 3000 tons.

Tenders (stating price delivered into the Tramway Tubs of the Corporation at their Wharf on the Leeds and Liverpool Canal) must be made upon a form to be obtained on application to the undersigned. They must be sealed, and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Town Hall, Burnley, endorsed "Tender for Cannel," and posted not later than Wednesday, the 31st of May, 1893.

By order,
JNO. P. LEATHER,
Gas Engineer.

Gas-Works, Burnley,
May 12, 1893.

CORPORATION OF LEICESTER.

COAL TENDERS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of COALS, COBBLES, or NUTS (about 110,000 tons per annum) for One, Two, or Three Years ending May 31.

Particulars and Form of Tender can be obtained on application to the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Gas Coal," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, the 3rd of June next.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.

Gas Offices, Millstone Lane, Leicester,
May 4, 1893.

CROMER, NORFOLK.

TENDERS FOR COAL.

THE Directors of the Cromer Gas and Coke Company, Limited, are prepared to receive TENDERS, from Colliery Proprietors only, for the supply of 800 tons of first-class GAS COAL, to be delivered at (*a*) the Great Eastern Railway Station, or (*b*) the Eastern and Midlands Railway Station, Cromer, between the 1st day of June next, and the 31st day of May, 1894. Weight given to be stated.

Deliveries to be made in such quantities and at such times as may be required by the Company.

Payment, net cash monthly.

Sealed tenders, endorsed "Tender for Coal," to be sent to the undersigned, on or before Monday, the 5th of June next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
P. E. HANSELL,
Secretary.

Cromer, May 19, 1893.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COALS.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 50,000 tons of best, well-screened, large GAS COALS, to be delivered between July, 1893, and June 30, 1894, in monthly quantities, in accordance with the Specification.

Parties tendering may do so for the whole quantity or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Thursday, the 8th day of June next, addressed to the Chairman of the Company, and endorsed "Tender for Coals."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
May 10, 1893.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Scarborough Gas Company invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works for a term of One Year from the 1st day of July, 1893.

Conditions of Tender and necessary Particulars will be supplied on application to the undersigned, to whom tenders, in accordance with such conditions, and properly endorsed, must be delivered not later than Saturday, the 3rd day of June next.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WILLIAM J. MOON,
Secretary and Manager.

Gas Offices, Scarborough,
May 12, 1893.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Leek Improvement Commissioners invite TENDERS for the supply of best screened GAS COAL and CANNEL for One, Two, or Three Years from the 1st of July next, to be delivered at the Leek Station, on the North Staffordshire Railway, at such times and in such quantities as may be required.

Annual consumption, about 4500 tons of Coal and 1000 tons of Cannel.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, by Four o'clock in the Afternoon of Monday, the 29th of May inst.

The lowest or any tender will not necessarily be accepted.

By order,
C. HENSHAW,
Clerk.

Town Hall, Leek,
May 12, 1893.

TO TAR DISTILLERS, MANUFACTURING CHEMISTS, AND OTHERS.

THE Directors of the Rochester, Chat-ham, and Strood Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works at Rochester and Gillingham for One Year commencing the 1st of July next.

In 1892 the quantity of Tar was about 306,000 gallons; of Liquor, about 960,000 gallons.

Further particulars may be had on application at the Office of the Company.

Tenders may be for Tar or Liquor separately or together, and are to be delivered at the Office, marked "Tender for Tar," or "Liquor," not later than Noon of Thursday, the 1st of June, 1893.

The Directors do not bind themselves to accept the highest or any tender; and security for due fulfilment of the contract must be given if required.

WILLIAM SYMS,
Secretary and Manager.

Gas Offices: 58, High Street, Rochester,
May 4, 1893.

MONTE VIDEO GAS COMPANY, LIMITED.

NOTICE is hereby given, that the TWENTY-FIRST ORDINARY GENERAL MEETING of the Company will be held at the Terminus Hotel, Cannon Street, London, E.C., on Wednesday, the 31st day of May, 1893, at Eleven o'clock in the Forenoon, to transact the General Business of the Company.

The Transfer Books will be closed from the 17th to the 31st of May inclusive.

By order,
A. G. HOUNSHAM,
Secretary.

Offices of the Company:
Suffolk House, Laurence Pountney Hill,
London, E.C., May 16, 1893.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE BY TENDER OF £5250 FOUR PER CENT. MORTGAGE DEBENTURES,
IN SUMS OF £50 OR MULTIPLES THEREOF, TO BE ISSUED THE 1ST OF JULY, 1893, AND PAID OFF AT PAR ON THE 1ST OF JULY, 1903.
Minimum Price, at the rate of £103 per cent. of the Amount of each Debenture.

THE Directors invite Tenders for the above-mentioned MORTGAGE DEBENTURES, to be sent to me before Eleven o'clock on the Morning of Wednesday, the 31st of May, 1893.

Printed Particulars and Conditions of Tender can be obtained at the Company's Offices, Katharine Street, Croydon.

WILLIAM J. RUSSELL,
Secretary.

May 3, 1893.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE BY TENDER OF 500 ORDINARY SHARES OF £10 EACH.
MINIMUM PRICE, £22 PER SHARE.

THE Directors give notice that they will be prepared to receive, not later than Eleven o'clock on the Morning of Wednesday, the 31st of May, 1893, sealed TENDERS for 500 ORDINARY SHARES of £10 each, to be paid up, in full, on the 30th of June, 1893, and to bear Dividend from that date.

The Dividend paid upon this class of Shares since the 1st of July, 1888, has been at the rate of 11 per cent. per annum.

One Share or any number of the Shares may be tendered for.

Printed Particulars and Conditions of Tender, and Form of Tender, may be obtained at the Offices of the Company, Katharine Street, Croydon.

WILLIAM J. RUSSELL,
Secretary.

April 26, 1893.

BOROUGH OF BURTON-UPON-TRENT.

TO COLLIERY PROPRIETORS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, are prepared to receive TENDERS from Colliery Proprietors for the supply of from 1000 to 25,000 tons of best Screened GAS COAL, to be delivered, in Sender's or Railway Company's Trucks at the Gas-Works Railway Siding, Burton-upon-Trent, between the 1st day of July next and the 30th day of June, 1894.

The deliveries are to be made in such quantities and at such times as may be directed by the Manager.

Payment, Net Cash Monthly.

Tenders, enclosed in an envelope, sealed and endorsed "Tender for Coal," are to be delivered to me at or before Ten a.m. on Friday, the 2nd day of June next.

The Council do not bind themselves to accept the lowest or any tender.

F. L. RAMSDEN,
Manager and Engineer.

Gas-Works, Burton-upon-Trent,
May 6, 1893.

LURGAN GAS LIGHT, AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 2500 tons of best screened GAS COAL, delivered into Lighters *ex*-ship at Belfast, free of all charges.

Delivery of 2000 tons will be taken before the 1st of November next; the remainder to be delivered at such times before the 1st of April, 1894, as may be required.

Vessels carrying from 200 to 300 tons can at once deliver into Lighters; and these Lighters be back for a further cargo within a period to be arranged and agreed upon by the Gas Company.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Ten o'clock in the Forenoon of Monday, the 5th of June next.

The Directors do not bind themselves to accept the lowest or any tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
May 8, 1893.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is hereby given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 6th of June, 1893, at Twelve o'clock at Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1893, and for the transaction of the General Business of the Company.

One of the Directors, Stephenson Robert Clarke, Esq., will retire from Office, but offers himself for re-election.

The Auditors, Robert Hesketh Jones and Thomas Guyatt, Esqs., will retire from office, but are eligible for re-election.

The Transfer Books will be closed from the 23rd of May until the day of the Meeting, both days inclusive.

By order,
A. W. COOPER,
Secretary.

60, Gracechurch Street, E.C.,
May 16, 1893.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

SALE BY TENDER OF £15,000 NEW STOCK, 1882.

IN pursuance of the Tottenham and Edmonton Gas Act, 1882, Notice is hereby given that it is the intention of the Directors to SELL BY TENDER £15,000 of NEW STOCK of the Company, to be paid up in full on or before the 31st of July next, after which date Dividend will commence to accrue, such Stock being the second portion of additional Capital authorized to be raised by Resolutions passed at an Extraordinary Meeting of the Proprietors, held on the 22nd of February, 1890, under the powers of the above-mentioned Act.

The Dividend on the Stock will be calculated half yearly up to the 31st of December and the 30th of June in each year, and will be paid by warrant issued within one week following the Half-Yearly Meeting of the Company, usually held on the last Saturday in February and August respectively in each Year.

A Deposit of 10 per cent. of the nominal amount of the Stock tendered for must accompany each tender.

Any amount not being less than £5, or a multiple thereof, may be tendered for; and the Stock will be registered in the Company's Books in the names of Allottees or their Nominees free of expense.

The minimum price below which no tender will be accepted has been fixed at One Hundred and Fifty Pounds Sterling (£150) for each One Hundred Pounds (£100) of Stock.

Particulars and Conditions of tender may be obtained on application to this Office; and sealed tenders must be sent in not later than Four o'clock in the Afternoon on Friday, the 16th day of June next.

By order of the Board,
JAMES RANDALL,
Secretary.

Offices of the Company:
Willoughby Lane, Tottenham,
May 5, 1893.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.,

London: WALTER KING, 11, Bolt Court, FLEET ST., E.C.

WEST HAM GAS COMPANY.

SALE OF 1750 SHARES.

MR. ALFRED RICHARDS is instructed by the Directors of the Company to SELL BY AUCTION, at the Mart, E.C., on Tuesday, May 30, at Two o'clock precisely, in Lots of 10 Shares each, 1750 £10 SHARES in the West Ham Gas Company.

The authorized Standard Dividend is 7 per cent., subject to the usual Sliding Scale Clauses.

The last Dividend on the same class of Shares was 5 per cent. per annum.

Particulars of the SECRETARY at the Company's Offices, STRATFORD, E.; of Messrs. HILLEARY, Solicitors, 5, FENCHURCH BUILDINGS, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

Now Ready, Price 6s., Cloth Bound.

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocardons; Tar for Gas Making; Destructive Distillation; Condensation; and Purification.

LONDON:
WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Price 6s., Cloth Bound, Bevelled Boards.

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

NOTICE OF REMOVAL.

TO GAS ENGINEERS & MANAGERS.

CROWTHER BROS.,

Contractors for Retort Setting, Erection of Gas Apparatus, and General Repairs, have removed from 384, Mile End Road, to

152, TEVIOT ST., ST. LEONARD'S ROAD,
POPLAR, LONDON, E.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

66, ROBERTSON STREET, GLASGOW.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

400,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

AUG. KLÖNNE,
DORTMUND (GERMANY).
REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

T. B. KITTEL, SHEFFIELD.
CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
T. B. KITTEL, SHEFFIELD.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER PORT GLASGOW."
Established 1872.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]
FALMOUTH GAS COMPANY,
Offices: *Church Street, Falmouth, January 25th*, 1893.

Messrs. the
WEARDALE IRON & COAL COMPANY, LTD.,
NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL,** received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{15}{20}$ tons of the Coal, mixed with 9$\frac{6}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{15}{20}$ tons.
Cannel Shale: 9$\frac{6}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13¼ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·54 CANDLES,** which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,
J. WM. BUCKLEY,
Engineer and Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., LD.,
QUAYSIDE, NEWCASTLE-ON-TYNE.

WILLEY & Co.,
Gas Engineering Works, Commercial Road, Exeter,
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

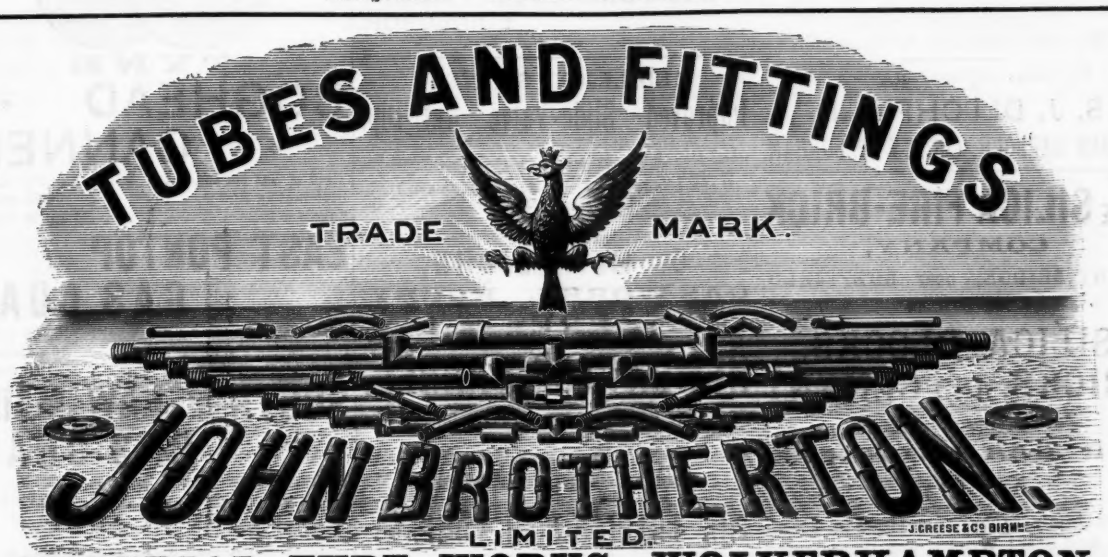
JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

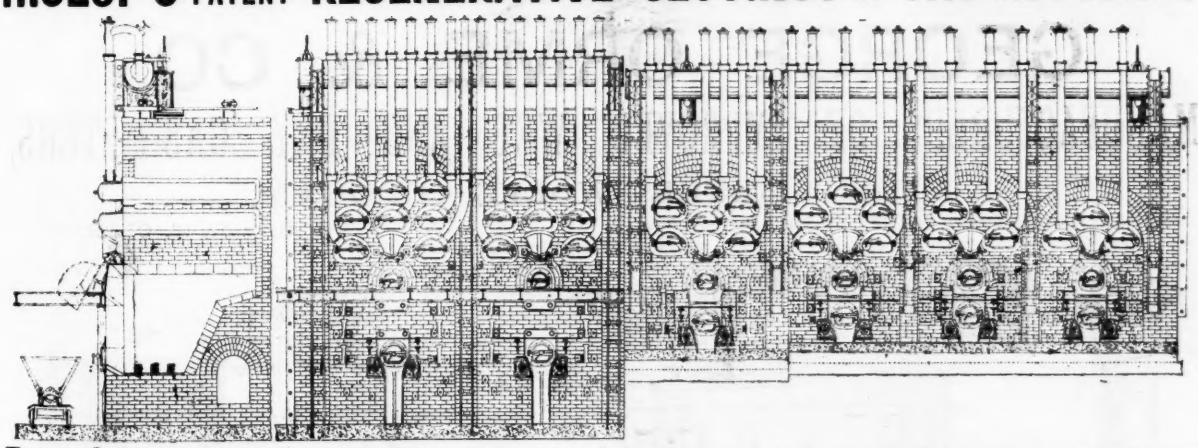
ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."



IMPERIAL TUBE WORKS, WOLVERHAMPTON.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,

4, York Buildings, Queen Street,
EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

MEIKLEJOHN'S PATENT

Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from

C. MEIKLEJOHN,

GAS-WORKS, RUGBY.

(Late N. MEIKLEJOHN, Longwood.)

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

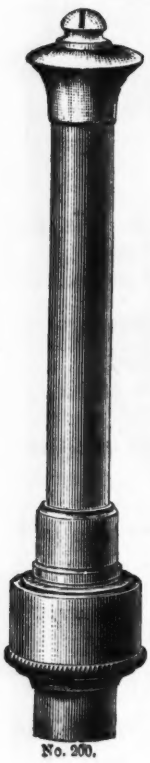
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE.
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

GEORGE ORME & CO.,

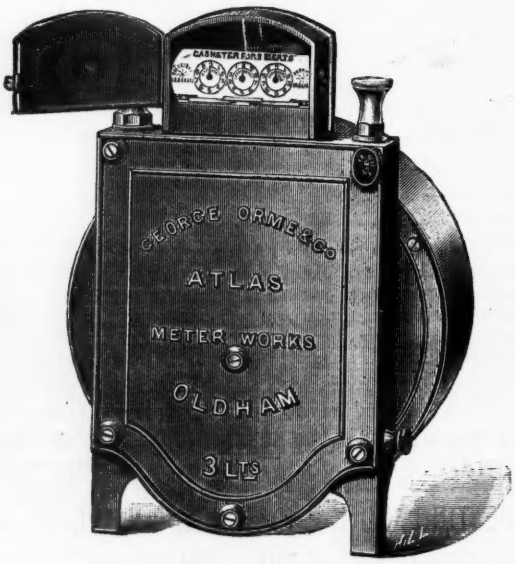
MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS,

ATLAS METER WORKS, OLDHAM.

Telegraphic Address: "ORME OLDHAM." Telephone No. 93, OLDHAM.



No. 200.



WET GAS-METER IN CAST-IRON CASE.

DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR (BEHL'S PATENT) FOR STREET LAMPS,

AS ILLUSTRATION NO. 200.

Adopted by the leading London and Provincial Gas Companies. **More than 150,000 now in use.**

ORME'S PATENT SUSPENSION REGULATORS.

Prices and full particulars on application.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.

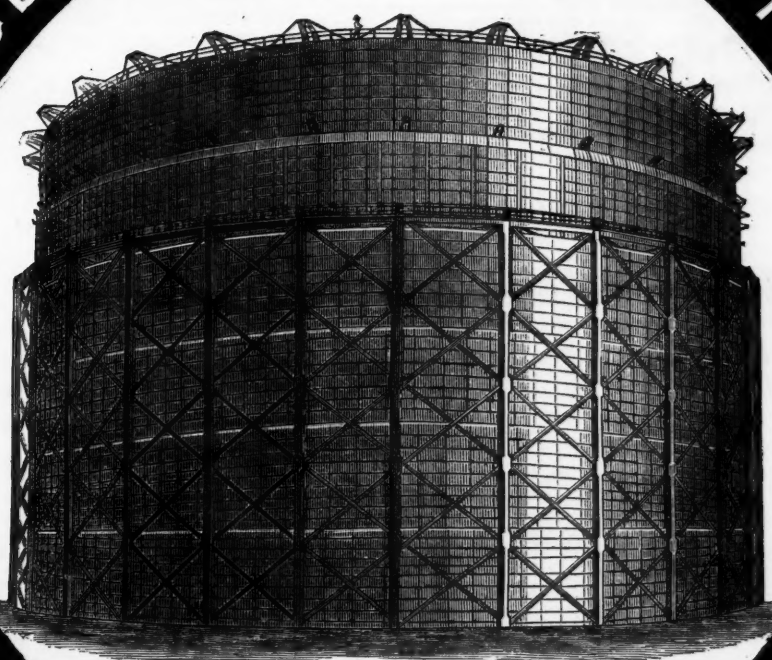
Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

CLAYTON SON & Co. LTD
MAKERS OF
WORKS LEEDS
THE LARGEST GASHOLDER IN THE WORLD
GASHOLDERS OUR SPECIALITY



CAPACITY 12 MILLION CUBIC FT.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW. M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
CXC	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

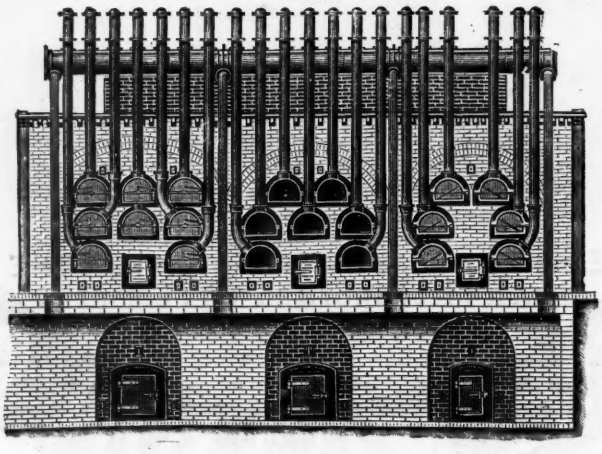
JONAS DRAKE & SON,

TELEGRAPHIC ADDRESSES:
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON"

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

OVENDEN, HALIFAX.

Now Ready, Price One Guinea.

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS & WATER UNDERTAKINGS.

1879-1890.

By E. H. STEVENSON and E. K. BURSTAL, M.M.Inst.C.E.

The Work published in 1879 by the late Mr. Stevenson is still on sale.

LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C.

HARPER & MOORES,

STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

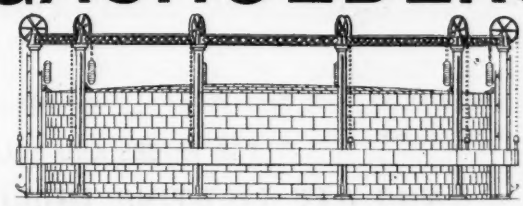
ESTABLISHED 1836.

HENRY BALFOUR & CO.,

LEVEN, FIFE.

MAKERS OF

GASHOLDERS



PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20, 1892

FOUR-WAY VALVES,

AND ALL CLASSES OF GAS APPARATUS.

HENRY PUPLETT, 47, Victoria Street, S.W.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.

ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.

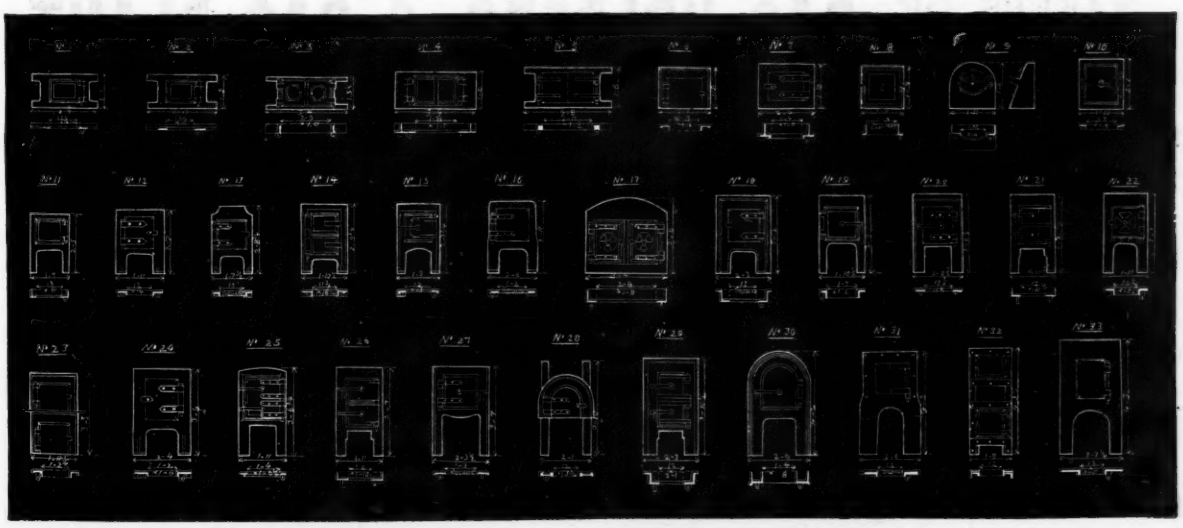
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

R. & J. DEMPSTER,

ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.



RETORT MOUNTINGS.

Furnace Doors and Frames suitable for Generator, Regenerator, and ordinary Retort Furnaces.

MOST OF THE ABOVE DESIGNS CAN BE MADE IN WROUGHT IRON, IF DESIRED.

Patterns for other Designs made to Order.

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

RETORT WORK

HORIZONTAL, INCLINED, REGENERATIVE, GENERATIVE, OR FLOOR-LEVEL SETTINGS.

J. & H. ROBUS,

ENGINEERS AND CONTRACTORS,

MANSION HOUSE CHAMBERS, 20, BUCKLERSBURY, LONDON, E.C.

ARE PREPARED TO ENTER CONTRACTS

FOR EXTENSIONS OR RENEWALS OF THE ABOVE WORK DURING THE ENSUING SEASON.

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED

FOR EXTENSIONS AND RENEWALS OF EVERY DESCRIPTION.

Contractors for the Erection of Gas-Works complete, including Gasholder Tanks of all sizes and Main Laying.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF

GAS HOLDERS & GAS PLANT.

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES,

PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF

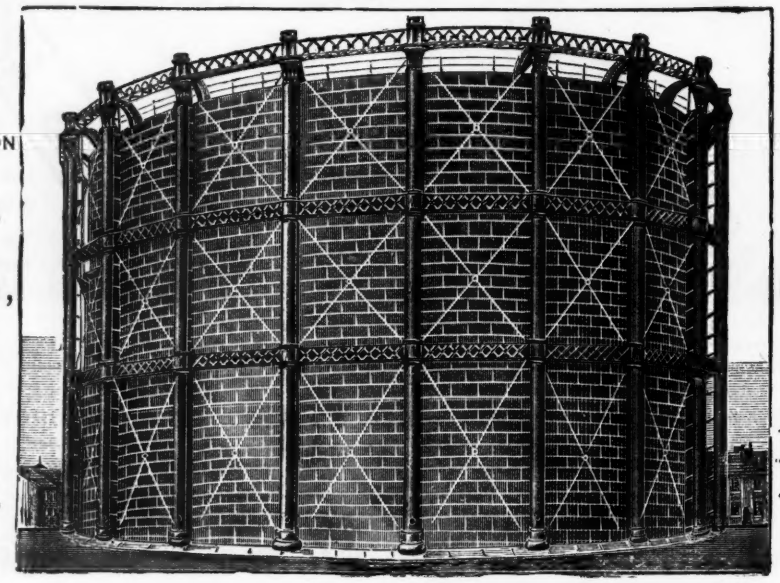
STRUCTURAL IRON

AND STEEL WORK,

BRIDGES,

ROOFS,

PIERS, ETC.



WORKS AND HEAD OFFICE:
TIPTON,
STAFFORDSHIRE.

LONDON OFFICE:
11, VICTORIA ST.,
WESTMINSTER.

TELEGRAPHIC ADDRESSES:
"HORSELEY, TIPTON."
"GALILEO, LONDON."

HYDRATED OXIDE OF IRON
FOR GAS PURIFICATION.

Two to three times as rich in Hydrate as Bog Ore.
STRONG ACTION ON SULPHURETTED HYDROGEN.
We have for sale Hydrate of Iron containing 77 per cent. of Ferric Oxide and 17 per cent. of Water. Directions given for mixing for Purifiers.
LESS THAN HALF THE PRICE OF BOG ORE.

APPLY TO—
READ HOLLIDAY & SONS, LTD., HUDDERSFIELD.

SOOTHILL WOOD CANNEL.

Yield of Gas per ton, over 12,000 cubic feet.
Illuminating Power - - - 26 candles.
Coke per ton - - - - - - 57 per cent.
Of a quality almost equal to that made from the best Coking Coal.

For Analysis and Price, apply to
THE SOOTHILL WOOD COLLIERY Co., LD.,
SOOTHILL WOOD COLLIERY,
BATLEY, YORKSHIRE.

The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
HENRY GREENE & SONS,
153 & 155, CANNON STREET,
LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

WILSON CARTER & PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of **LYON'S 'PATENT' GAS MAIN SYPHONS.**
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

TELEGRAPHIC ADDRESS, "GAS LEEDS."
CLAYTON, SON, & CO.
LIMITED,
LEEDS,
MAKE
RETORT LIDS
OF ALL FORMS AND SHAPES IN IRON OR STEEL
BY SPECIAL HYDRAULIC MACHINERY.
LONDON OFFICES 60, QUEEN VICTORIA STREET, E.C.
PRICES ON APPLICATION.

J. & W. HORTON
ETNA WORKS,
SMETHWICK,
NEAR BIRMINGHAM
(Established 50 Years),
PATENTEES
AND
MANUFACTURERS
OF

IMPROVED GASHOLDERS AND BOILERS

and Manufacturers of every description of
Gas Apparatus,
Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

Crosbie's Manufactures have been supplied to the following Local Authorities and Gas-Works:—

ABERDOVEY.
ABERGAVENNY.
ALDRIDGE.
ANTRIM.
ARMAGH.
ASCOT.
BALLYMENA.
BENTHAM.
BIRMINGHAM.
BOGNOR.
BRAMHAM.
BRANDON.
BROADSTAIRS.
BROMSGROVE.
BURTON.
CARLOW.
CHESTERTON.
CLITHEROE.
COBHAM.
COVENTRY.
CRANBROOK.
CULLEN.
DEWSBURY.
DOWNPATRICK.
ELLAND.
ELLESMERE.
GARSTON.
GILLINGHAM.
GOREY.
HANLEY.
HENDON.
HINCKLEY.
HONITON.
HUNTINGDON.
ILKESTON.
IRTHLINGBORO'

Contractors to Her Majesty's Government and the Indian Government.

Contractors to the Turkish Government, The London County Council, and many Local Authorities.

Crosbie's Manufactures have been supplied to the following Local Authorities and Gas-Works:—

KEGWORTH.
KILDWICK.
KILRUSH.
KIRKBURTON.
KNUTSFORD.
LEEK.
LEVEN, N.B.
LIMERICK.
LONDON COUNTY COUNCIL.
LYMINGTON.
MERTHYR TYDVIL.
MILBORNE PORT.
NORTH MIDDLESEX.
PENMAENMAWR.
PEMBROKE.
PORTADOWN.
PORTRUSH.
PORTSMOUTH.
RAUNDS.
ROCHESTER.
RUGELEY.
SEAHAM HARBOUR.
SHIPSTON-ON-STOUR.
STAFFORD.
STAMFORD.
STROUD.
SUDBURY.
SWINTON.
UTTOXETER.
VENTNOR.
WARWICK.
WEXFORD.
WIGSTON.
WITNEY.
WOLVERHAMPTON.
WORKINGTON.

CROSBIE'S PAINTS.

GUARANTEED GENUINE AND FREE FROM ADULTERATION.

GUARANTEED GENUINE AND FREE FROM ADULTERATION.

CATALOGUE AND TESTIMONIALS ON APPLICATION.

ADOLPHE CROSBIE, LTD.,

Colour Works, WOLVERHAMPTON.

CLAPHAM BROTHERS, KEIGHLEY. ESTABLISHED 1837.

The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas is

WELLINGTON, NELSON, & MARKET ST. WORKS.
Telephone No. 2235.
Telegraphic Address: "CLAPHAM BROTHERS Keighley."

Laycock and Clapham's Patent.

The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

The Shaft Revolves in Improved Bearings, and all Workings are accessible.

REPAIRS AND TROUBLE REDUCED TO A MINIMUM.

"YOU DON'T SAY SO!"

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, May 23, 1893.